# OCCUPATIONAL HEALTH AND SAFETY STUDY

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CENTRE FOR OFFSHORE AND REMOTE MEDICINE

FACULTY OF MEDICINE

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

A. M. House
H. J. Manson
J. R. Martin
T. M. Rahal

MEMORIAL UNIVERSITY OF NEWFOUNDLAND
St. John's, Newfoundland, Canada A1B 3V6

*Center for Offshore & Remote Medicine (MEDICOR)*
*Faculty of Medicine*
*The Health Sciences Centre*

*Telex: 016-4101*
*Tel.: (709) 737-6433*

# HEALTH AND SAFETY STUDY

This Study was carried out by the Memorial University Centre for Offshore and Remote Medicine (MEDICOR) for the Royal Commission on the "Ocean Ranger" Marine Disaster and was submitted in November 1983. The opinions expressed in the Study are those of the authors.

A. M. House

H. J. Manson

J. R. Martin

T. M. Rahal

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The terms of reference of the Study are summarized in the Study outline Appendix I

List of consultants, advisors and resource individuals is included in Appendix II

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## MEDICOR HEALTH AND SAFETY STUDY TEAM

A. M. HOUSE, M.D., F.R.C.P.(C), Professor of Medicine (Neurology); Associate Dean, Continuing Medical Education and Clinical Affairs; Director of the Centre for Offshore and Remote Medicine. Dr. House is Director of the Study team. He is a practising neurologist, a medical educator and administrator and has a long interest in distance education and remote medicine with emphasis on offshore medicine. He has had extensive experience with the use of telecommunications in health and education.

H. J. MANSON, M.B., Ch.B., F.F.A.R.C.S., F.R.C.P.(C), Associate Professor of Anaesthesia; Assistant Director of the Centre for Offshore and Remote Medicine; C.M.E. Program Coordinator for Offshore Medicine; practising anaesthetist; consultant in diving medicine; research interests in hypothermia and hyperbaric medicine.

J. R. MARTIN, M.D., F.R.C.P.(C), Professor of Medicine (Rheumatology); Director of Northern Medicine; experience in occupational and environmental medicine including the direction of a major study on health problems in the mining industry; practising rheumatologist.

T. M. Rahal, B. Comm., M.B.A., Research Associate; experience in health administration.

Senior Consultant

Professor Nelson Norman, M.B., Ch.B., M.D., F.R.C.S., D.Sc., Director, Centre for Offshore Health, Robert Gordon's Institute of Technology, Aberdeen; formerly Director of the Institute of Environmental and Offshore Medicine, Aberdeen University; extensive background in surgery and remote medicine with particular interest in diving medicine and hypothermia; consultant to British Antarctic Survey.

Research Associate

J. Brebner, R.M.N., R.G.N.

Chapter 1

# INTRODUCTION

This "Occupational Health and Safety Study" of offshore oil workers was undertaken by a team and consultants who collectively covered a wide range of qualifications and experience in different medical specialties. They were formed to focus their expertise on problems which are emerging or can be anticipated in the relatively new setting of oil operation on the Canadian East Coast. For some problems, principles and procedures from medical practice can be applied directly or by being modified. For others, new approaches must be developed and implemented.

In contrast to conventional studies or investigation in Medicine where a volume of basic knowledge is usually available as background, the literature on "Offshore Medicine" has not yet accumulated to the degree that it can represent an established body of knowledge based on recognized principles. The available information is mainly in the form of ad hoc accounts of experiences and comments and conclusions drawn without the rigorous testing demanded in scientific reporting. Much of this information is as yet unpublished.

## 1.1 METHODOLOGY

Because of the 'state of the art' in this area of knowledge, the approach taken by the Study was largely consultative. The available literature was reviewed and some limited research was conducted during the year. However, the main emphasis was on collecting information in numerous meetings and detailed discussions between members of the team and Federal and Provincial Government agencies, industry, educational institutions, individuals and groups in Canada. To a lesser degree, representatives of these agencies in the U.K. and Norway were also approached and contributed to the Study. Consultants and resource people from the U.K., U.S.A., and Norway were involved through the Study. Minutes were kept of the information acquired from these sources, and of the team's discussion of consultants' reports.

At the beginning, an assessment was made of the status of offshore health, drawing on the experiences in the United States, the United Kingdom and Norway. From this base, the study progressed by accumulating information from other external sources and by assessing its relevance for the local scene. The database is thus mainly composed of reports, narrative accounts and commentaries.

## 1.2 THE ORGANIZATION OF THE REPORT

To identify the issues, problems and potential solutions, the

report follows a sequence starting from the time a worker seeks employment. At this stage, his job will be affected by underlying jurisdictional, legal and administrative matters. Before he is sent offshore, he will be given a pre-employment assessment followed by a period of training to prepare him for the workplace, including adequate First Aid training. The potential hazards of the workplace are then assessed with a discussion of the illnesses and accidents which may occur, and the preventative health and safety measures which can be used.

Because illness and accidents will almost inevitably occur, there is a review of health resources on the rig needed to provide adequate care, including personnel, supplies, space, equipment and medications. If the worker's medical problem is beyond the capability of offshore resources, there may be a need for advice from a physician onshore or for a visit by that physician to the offshore installation. Supplies needed to accompany the physician and backup medical coverage are discussed. Adequate communication links and transportation to meet the particular need must be available. If the patient's problem cannot be managed within the company's resources, land-based services may be sought. These will range from providing consultation and advice to the medic or physician to the dispatch of the Medical Emergency Response Team with eventual evacuation and reception of the patient at the shore-based facility.

Because support services are required offshore, the report deals with health, considerations of supply ships and standby vessels. Attention is paid to the unique problems of diving, hypothermia and exposure. A worker who needs to be evacuated for medical reasons may return to his job or may require short- or long-term compensation. The relationship between the various agencies responsible for many aspects of offshore health is discussed throughout and a method of maintaining and reviewing an overall emergency plan is proposed.

## 1.3 THEMES AND CONCLUSIONS IN THE REPORT

To meet the concerns about health and safety in the Canadian offshore oil operations, it is obvious that a number of existing agencies and institutions have had to change their orientations and extend their functions to deal with relatively new problems. Precedents and experience can be drawn from other parts of the world, but these have to be accommodated to the unique Canadian conditions.

Thus, there is an advantage in having COGLA as the 'single window' on the Canadian offshore, but its effectiveness will rest upon its collaboration and interaction with other agencies, both Provincial and Federal.

In health and safety matters, the opportunities for consultations

with appropriate authorities has been delayed because company physicians have tended not to be given significant administrative roles in industry. Physicians and other health personnel in government agencies, such as Occupational Health, have not been involved in such matters.

The basic principle to be offered is that the quality of health care for workers in the Atlantic offshore should be, at least, comparable to that provided generally for workers in Canadian industry. To ensure that this principle is maintained, a number of special and unique features have to be taken into account, depending upon cooperation between companies, federal and provincial agencies, and educational institutions.

There is a need for integration of health personnel with their counterparts in safety, both in industry and in government agencies. This interface between health and safety has not been developed with any degree of consistency, but awareness is growing that safety and health are inevitably linked.

There are hopeful signs that expertise is emerging and can be used as resource in the complex legislative and practical issues presnted by offshore oil.

The report deals with a wide range of topics ranging from safety pins on life rafts to 'fly-away' compression chambers, from an individual hurting himself by falling to a wide scale disaster offshore. To orient the reader, broad themes can be identified under the heading of

1.3.1 Regulation

1.3.2 Communication

1.3.3 Education and Training

1.3.4 Health Resources

## 1.3.1 REGULATION

Chapter 2 indicates that in comparison with the U.S.A., the U.K. and Norway, Canadian offshore health and safety jurisdictional matters are more complex. It is suggested that regulation is required to ensure uniform standards of training of health personnel, of supplies and equipment. This can be achieved by enacting new legislation, but in the meantime, regulation can be achieved by incorporating health and safety requirements in the licence issued to operators. COGLA is recognized as the 'single window' for Canadian offshore oil operation, but this federal agency must interact with the Provincial Departments of Health, Labour and Education who have the prime responsibility in these fields.

In Chapter 3, the idea of regulation can be applied to determining standards for the pre-employment medical examination. It is asserted that minimum standards should be set by the regulatory agencies. This examination should be carried out by physicians experienced in the offshore work setting and should be regarded as the basic step in ensuring safety, reducing illness and optimizing response to accidents offshore.

Chapter 4 examines the working environment and conditions offshore and recognizes that the present legislation presents guidelines rather than specific regulation of standards for living, working, recreational and health facilities.

In Chapter 7, the role of the regulatory agencies in framing standards for health facilities, equipment and supplies is advocated. Some inadequacies are pointed out in the present regulations covering medical supplies and equipment for lifeboats and life rafts. In general, it is felt that responsibility should be placed on the company, and the better prepared the company is to deal with emergencies, the less will be the need for detailed regulations.

To carry out the suggestion in Chapter 9, that universal First Aid training be required, modification would have to be made to recognized courses in First Aid. Because of these modifications, the offshore regulatory agencies may have to act as the certifying body.

Chapter 10 deals with the roles and functions of standby vessels, as covered by existing regulations. It is suggested that the rescue functions of such vessels should be reassessed in the light of Canadian conditions, including the possible conflicts in their roles as supply vessels and their use in iceberg towing. In the area of diving safety (Chapter 12) strict enforcement of regulations is required.

Some legal status for the Canadian ex-military medic will have to be sought to allow recognition for practice and for continuing education (Chapter 8). This may be achieved under the Canadian Medical Association standards for Allied Health Professions without involving new regulation, or by special considerations by the Provincial Department of Health.

A detailed examination of the relevant regulations and of the role of the agencies in medical emergency contingency planning is carried out in Chapter 14. The need for stringency and for the input from health professionals is stressed.

### 1.3.2 COMMUNICATION

Communications in this context refers not only to the need for technically adequate communications links such as are described in

Chapter 11, but also to the need for interactions between federal, provincial and other agencies involved in health and safety. Thus, in Chapter 2, the theme is introduced of the need for collaboration and cooperation between agencies, with consultation from health professionals. This theme continues throughout the report.

In the communication between rig medic and patient raised in Chapter 8, there is a need for maintaining an accepted professional relationship. Because of loyalties to company standards and expectations, the rig medic may experience conflicts of interest. These conflicts and the need for clear lines of responsibility between the medic and physician are also dealt with in the reviews of emergency contingency plans in Chapter 14.

Communications systems are reviewed in some detail in Chapter 11, and recent advances are described which could be used in providing reliable links for routine and for emergency use. This chapter also reviews transportation and indicates the obvious preference for helicopter use in evacuation. Ambulance services are considered, and in this and Chapter 13, the lack of a life support ambulance and the need for further training of attendants are discussed.

The issues of communication and transportation are also raised in Chapter 12 where it is noted that evacuation of the diver in saturation presents problems and requires the provision of a medical hyperbaric facility in St. John's (Chapter 13).

### 1.3.3 EDUCATION AND TRAINING

The theme of training personnel occurs in Chapter 4 when the need is expressed for the crew to be informed on health hazards and on emergency procedures (Chapter 8). Universal First Aid training is advocated for workers, for the rig crew, and for the crew of standby vessels in Chapters 9 and 10. While some authorities hold that only some crew members need have this training, it is claimed that this could be detrimental to health and safety in the event of accident and illness. Advanced First Aid training should be required of approximately 10% of the crew. This advanced First Aid team could assist the rig medic in emergencies, serve as escorts to patients being evacuated and could provide First Aid in lifeboats in the event of abandonment (Chapters 8 & 9). The training required for medical attendants on supply vessels is addressed in Chapter 10. Special training for members of the diving team, especially life support technicians, is advocated in Chapter 12.

In Chapter 8, the duties expected of a rig medic as an extension of the physician are set out in detail as a basis for reviewing the type and level of qualifications required. Some orientation for offshore duties is deemed necessary, but this can be provided

by modular training courses suitable for individual needs. The training of Emergency Medical Technnicians (paramedics) is not considered to be adequate for rig medics. Nurse and ex-military medics trained for independent duty are considered to be suitable with further training. The lack of legal status in the health system of the ex-military medic will have to be rectified. Recognition as an Emergency Medical Technician by the Canadian Medical Association is one method of achieving this legal status, but the EMT certification by itself should not be recognized as sufficient qualifications for a rig medic.

In addition to orientation and special training, physicians and rig medics should be required to take continuing education courses involving practical training and theoretical instruction. The facilities for such training and continuing education can be provided by appropriate educational institutions on a cooperative basis (Chapter 8).

It is recognized that in many areas of health and safety offshore, more knowledge is needed. In Chapter 4, the need for research involving long term studies is stressed as a matter of immediacy, in areas such as hypothermia, the effects of noise, the appropriate diet, exposure to hydrocarbons, stress conditions and personal factors in adapting to the offshore environment are specified. In Chapter 5, after describing illnesses which have presented or could present on the Canadian East Coast, it is advocated that data be collected to provide a general profile of the health of workers.

Chapter 6 highlights the difficulties of collecting reliable data on accidents then, recognizing the limitations, presents data on accidents which have occurred. Again the need is expressed for more systematic collection and analysis of accident data. In Chapter 7, design standards for protective clothing are criticized in the light of a discussion of the severe hazards of hypothermia. New designs should be developed by combined study by a wide range of experts. Again, expert input is required in designing a new hyperbaric facility and in studying a number of issues involved in the health care and safety of divers.

### 1.3.4 HEALTH RESOURCES

In Atlantic Canada, apart from the need for improved hyperbaric facilties (Chapter 12) and some other minor needs, health resources are considered adequate (Chapter 13). Concerns are expressed in this chapter about resources in remote sites, but the increasing involvement of the Department of Health should ensure the provision of adequate facilities. More involvement by the Public Health divisions is advocated in Chapter 14.

Medical directors, company physicians and rig medics should be considered as a professional team (Chapters 8 and 13), with the

medical director having overall responsibility, and the suitably qualified medic as the person best qualified to provide health care offshore. Ambiguities of roles and responsibility which occur on many rigs, at present, should be resolved (Chapters 2 and 14).

The Medical Emergency Response Team (Chapter 13) is a vital component in planning for emergencies and disasters. To enable this team to be established formally, adequate malpractice and personal insurance coverage should be available (Chapters 2 and 13). The types of supplies and equipment to be provided, both offshore and onshore, are listed and reviewed (Chapters 7, 10, 12 and 13).

As a health care system, the effectiveness of offshore health care can be assessed and monitored by systematic study.

Chapter 13 analyzes in detail the medical facilities available onshore and returns to the theme of cooperation between institutions by stressing the need for an overall emergency plan. Chapter 14 indicates that there is a need for a committee with representatives from a number of agencies to meet regularly to devise and keep up-to-date, suitable plans for dealing with emergencies, including the development of an integrated communications network between designated centres.

## 1.4 CONSEQUENCES OF THE STUDY

It is well recognized that the process of conducting a study such as this may, by itself, create change independent of the actions which may follow its completion. During the course of the present Study, a number of positive changes have occurred since September 1982. The organization of medical emergency contingency measures is virtually complete, but a number of important refinements still remain before there can be confidence in a optimum response to a major emergency offshore. Some developments have already taken place in the delineation of areas of responsibility of health personnel within oil companies, but substantial further improvements are clearly indicated. A move to improve cooperation between health and safety divisions in industry has only just begun. Further, agencies of government are now beginning to seek expert advice as they develop their regulations and guidelines.

The consultative approach taken during the Study has had an educational value with the result that there is now a small cadre of well informed individuals, locally and in Canada, who are recognized as being interested in offshore health care and cooperation between a number of educational institutions is developing.

Chapter 2

# JURISDICTIONAL REGULATORY, LEGAL, AND ADMINISTRATIVE CONSIDERATIONS

## 2.1 INTRODUCTION

On the eastern Canadian continental shelf almost all Mobile Offshore Drilling Units ( MODUs) are foreign registered and have been constructed and equipped under foreign regulations and guidelines. These drilling units usually have a significant number of foreign crew and workers and their operators usually adhere to the philosophy of their multinational parent companies and the countries of registry. Some of these countries have left health and safety standards almost entirely to the discretion of the operating companies. Others, such as Norway, enforce detailed regulations through the Marine Directorate and MODUs registered in Norway are required to comply with Norwegian regulations, even when operating in foreign waters.

It is not the mandate of this study to provide an indepth review of the various jurisdictional, legal, and regulatory issues involved in the continental shelf petroleum resources. The Dalhousie Ocean Studies Program study "Safety in the Design, Construction and Operation of Offshore Oil and Gas Installations" provides a detailed comparative analysis of the regulatory structures in the United States, Norway, the United Kingdom and Canada for offshore health and safety matters. However, some appreciation of the regulations adopted by other countries is essential in order to assess the status of occupational health and safety of workers in the Canadian offshore petroleum operations, to identify the major problems, and propose solutions.

The following is a brief review of the regulatory structures of various countries.

## 2.2 REGULATORY STRUCTURES IN NORWAY, THE UNITED STATES, THE UNITED KINGDOM AND CANADA

### 2.2.1 NORWAY

By Acts and Royal Decrees, Norway has developed an extensive and detailed list of regulations covering almost all aspects of health and safety, and involving many government departments and directorates. The licensing process requires operators to comply with the many and sometimes overlapping regulations of nearly a dozen government agencies, and misunderstanding and confusion may arise.

Generally, the regulation and monitoring of health matters on fixed rigs is clearly defined in that the Norwegian Petroleum Directorate is responsible for safety matters and the Health Directorate is responsible for health matters. Difficulties arise in establishing a common approach to the interface areas between health and safety, especially as the Health Directorate is responsible for the approval of the first aid section of the basic offshore safety training courses required of all workers (1).

For mobile units the Marine Directorate is responsible for health and safety, unless the MODU is used for accommodation (flotel) purposes whereupon the Petroleum Directorate assumes responsibility for safety and the Health Directorate for health matters as with fixed installations (2). Pre-employment assessment of workers on MODUs is the responsibility of the Marine Directorate, whereas on fixed rigs it is the responsibility of the Health Directorate (1). Given this confusion of responsibility, there are some standards acceptable to the various directorates including the requirement that rig health workers (medics) must be Norwegian registered nurses (3)(4)(5).

On the positive side, the Norwegian Petroleum and Health Directorates have the right to inspect all installations operating on the Norwegian continental shelf without notice, and inspectors have priority rights to the operator°s helicopter services (7). The registration of health professionals is a straightforward matter because both Norwegian civil and criminal law apply on the Continental Shelf (6), in marked contrast with the existing situation in the Canadian offshore.

The Norwegian system, with firm and detailed regulations covering many directorates, requires a large beaurocracy and places strain on a relatively small cadre of expert government professionals. A consensus of opinion is growing that focussing responsibility on one agency (the "single window") would have advantages over the present arrangements in Norway.

### 2.2.2 UNITED STATES

In the United States a number of government agencies deal with the offshore oil industry. While some areas such as diving are covered by minute and detailed regulations, the overall responsibility for health care and safety is generally assumed by the operating oil companies (8)(12). This is particularly true with respect to education, training and certification of health and safety personnel (9). There are no common standards or guidelines applicable to the education and training of health and safety personnel or to health care across the petroleum industry (8). Consequently each company, using its own resources, or those of private medical organizations, provides the level of care it

considers appropriate. The lack of comprehensive regulation of health and safety has fostered the proliferation in the U.S. of a number of private educational and medical entrepreneurial organizations which provide a variety of medical and educational services to industry. Some of these programs are of high quality, while others are considered to be inadequate.

The U.S., like Norway, spreads responsibility (with significant overlaps) for health and safety matters over more than a half dozen relatively autonomous federal agencies (9). Furthermore there are differences in health and safety codes between states and state and federal regulations sometimes conflict. Generally there is much less regulation in the U.S. than in Norway and the U.K.

In the U.S. health care in general is essentially the responsibility of the individual and in terms of offshore medicine this translates into private services arranged by the companies. The Canadian health model is much closer to that of Norway and the U.K. than to the U.S.

### 2.2.3 UNITED KINGDOM

The United Kingdom government implements its regulations, as broad guidelines for industry, through the "single window" of the Department of Energy. As Higginson (18) points out, responsibility for safety, health and welfare has been delegated to the operating companies and to date these matters have not been subject to specific regulations by government. Government inspection of the MODUs and installations is conducted at times convenient to the operator.

Although the majority of U.K. civil and criminal laws apply to the continental shelf, there is no requirement for registration of health professionals working offshore (6). Education, training, and the determination of the qualifications of offshore health providers, is primarily the responsibility of industry. Government regulations implemented through the Department of Energy tend to require industry to follow broad guidelines (8). Over the years the very active industry association (UKOOA) has developed standards for all aspects of health and safety to the point that certain companies well exceed the minimum standards suggested by government agencies.

Prior to 1980 and the Offshore Safety Report by the Burgoyne Commission there was considerable argument as to whether one agency, which is primarily interested in development and production, should have the responsibility for health and safety. The Burgoyne Commission recommended that the single agency (Department of Energy) approach was preferable providing there was

adequate involvement of the Health and Safety Executive (10). Since 1980, while not having regulatory responsibility, the Health and Safety Executive has had an increasing role in the development of occupational safety regulations and guidelines.

The U.K. decision to place the responsibility for framing guidelines within industry and to rely on industry for supervision and implementation has led to criticisms of insufficient public accountability. In fact, the consultative process between government, industry and educators has resulted in the development of practical guidelines which appear to have the acceptance of all parties.

### 2.2.4 CANADA

Canada has exclusive rights over hydrocarbon resources on the east coast and regulations have been enacted by both the Federal and the Newfoundland Provincial governments. As foreign registered MODUs are considered to be governed by the laws of the country of registration, MODUs are licensed to drill on the Canadian East Coast on an individual basis. Thus, priorities given to matters of health and safety, stocks of drugs and medical equipment and qualifications of health personnel can differ among drilling units.

Under current practice, Canada does not have any legal control of offshore health care, safety, education and training other than in the case of Canadian registered vessels. Therefore compliance with Canadian regulations cannot be generally enforced by legal penalties. Contingency planning would be vastly improved if all MODUs were licenced to a minimum Canadian standard. Canada could, by enactment of the necessary legislation, require compliance with Canadian law by non-Canadian registered vessels and installations as is required in the U.K. and in Norway (when Norwegians are members of crews).

In the absence of this legislation compliance could be effected through the existing licencing mechanism if the terms of the licence required the operator to meet appropriate Federal and Provincial government regulations. The requirement for compliance with Provincial laws is important since health is constitutionally a Provincial jurisdiction in Canada. For complete compliance the operating company would have to accept full responsibility for its contractors and subcontractors, thereby ensuring that the same standards could be applied to all offshore workers.

## 2.3 FEDERAL/PROVINCIAL RELATIONSHIPS WITH THE OFFSHORE OIL INDUSTRY

The Canada Oil & Gas Lands Administration (COGLA)is the primary regulatory agency responsible for offshore oil operations. A Memorandum of Understanding between COGLA and the Canadian Coast Guard (CCG) signed in 1982 outlines the mechanism to deal with overlapping jurisdictional matters between the two agencies. Thus incidents pertaining solely to drilling activities are the responsibility of the Ministry of Mines and Energy (COGLA) and incidents pertaining solely to navigability, seaworthiness and marine safety are the responsibility of CCG as a unit of the Ministry of Transport.

While this memorandum also sets out a mechanism to deal with areas of overlap, ambiguities persist in the relationship between the two organizations with respect to diving support vessels, barges and standby vessels involved in the offshore industry. Further ambiguities arose when, in the recent Seafarers International Union case the Canadian courts declared that all workers in the Atlantic offshore are considered to be covered by the Canadian Shipping Act (11). There is some uncertainty as to whether this decision relates only to labour matters or whether it applies to matters such as health and safety.

The concept of COGLA as the "single window" through which Canada exercises its control over hydrocarbon development could permit a direct relationship with the Federal Department of Health and the other departments concerned thus facilitating the development of minimum standards of offshore health services. However, COGLA is a relatively new government body, and formal arrangements for consultation with departments such as Health and Welfare Canada and Labour Canada are only in the initial stages.

In addition to the need for consultation at the Federal level, cooperation at the Provincial level is required as health services are provided through Provincial resources. COGLA has indicated its intention to work through the appropriate Provincial services and consultations have begun between COGLA officials and health professionals in the Provincial and Federal governments, in industry and in academic institutions.

### 2.3.1 PROVINCIAL AGENCIES

Several intragovernmental organizations have been established in Newfoundland and Nova Scotia to coordinate the Provincial involvement in the offshore.

a) Newfoundland

In Newfoundland, the Newfoundland and Labrador Petroleum Directorate, (NLPD) established under the Newfoundland Petroleum and Gas Act, is responsible for occupational health and safety in the offshore. While the regulatory approach of the NLPD is similar to that taken by COGLA there are some differences. For example, the regulations covering winter drilling in Newfoundland have some implications for health beyond those covered by COGLA.

While all health facilities in Newfoundland are controlled by the Provincial Department of Health, the enforcement of health and safety regulations in industry is the responsibility of the Health & Safety Division of the Department of Labour. The Newfoundland Workers' Compensation Board is responsible for health care and compensation of workers for industry-related accidents and diseases and covers both Canadian and foreign workers.

The Petroleum Directorate as Newfoundland's "window on the offshore" has been coordinating the resources of these government agencies and in the last year there has been increasing communication and consultation between the Newfoundland Petroleum Directorate and the appropriate departments of the Provincial Government. Continuing consultation and careful allocation of responsibility to the various agencies will be essential if services are to be optimum and coordinated.

b) Nova Scotia

In Nova Scotia the government approach is substantially different from that of Newfoundland. The overall control and regulation is vested in the federal government, input from the province being provided through the federal provincial coordinating committee structure. To date none of the provincial government departments and agencies in Nova Scotia have had any significant involvement in offshore health and safety (13)(14).

The Workers' Compensation Board of Nova Scotia has the mandate to provide for medical care and compensation of workers, but only requires the employer to report accidents involving residents of Nova Scotia (14). It conducts health and safety inspections and accident prevention training which includes first aid training. To date this Workers' Compensation Board has treated the offshore as any other industry and has not reported any unique or major concerns.

## 2.4 REGISTRATION AND LICENCE

A number of issues must be resolved before satisfactory regulation of professional training and practice for offshore health workers can be attained. Since neither Canadian civil and criminal law, nor Provincial law, apply on Canada's continental shelf, the current Provincial registration and licencing procedure is meaningless. Outside of the industrial licencing process there is no mechanism to enforce a certain level of qualifications and registration of physicians and other health workers. In Newfoundland the unsettled jurisdictional dispute between the Provincial government and the Federal government further complicates the situation.

Even though the Federal-Nova Scotia agreement makes issues relating to health care on the Nova Scotia continental shelf somewhat easier to deal with on a jurisdictional basis, responsibility for registration and licencing of health professionals remains unsettled.

Except within the armed forces, there is no nation-wide registration permitting physicians or nurses to practice broadly in Canada. Both professions must be registered in a Canadian province and reciprocal registration between provinces is generally accepted.

The registration of offshore health workers is hindered by the lack of Provincial recognition of some health care providers (e.g., non-R.N. medics), even though they may be considered competent by supervising physicians. There is a recognized professional relationship between registered nurses and physicians, but the retired Canadian armed forces medic trained to the level of TQ6B who may work in the offshore has no legal standing or recognized professional relationship with the supervising physician. Resolution of this anomaly may not be easy but will be necessary if the pool of well trained Canadian armed forces medics is to be made available to industry.

The issues involved in seeking to licence and register health professionals are compounded by the fact that currently on a foreign registered MODU the offshore health worker from a foreign country may not be eligible for registration in a Canadian province due to inadequate training and qualifications. Further, this health worker may not be a direct employee of the operator. Nevertheless, the Medical Director or his designate, who is usually the local supervising physician, must use the services of this medic in exercising responsibility for the quality of health care provided to all the workers on the drilling unit.

As indicated previously, the final control of health services

rests with the licencee and the country of registration of the offshore installation. The alternative was suggested that in the terms of the Application to Drill the government would stipulate that the operator, together with the contractor and any subcontractors he engages, be bound to comply with the Canadian guidelines and procedures. The onus of responsibility for meeting health and safety standards would thus remain with the operator. This solution provides ease of administration for the government, as it could be implemented within the existing licencing arrangements, without the need for new legislation.

## 2.5 MALPRACTICE INSURANCE

Although no major malpractice problems have arisen on the Canadian East Coast, physicians are at risk of being sued. As discussed in the section 13.1.2, Canadian physicians have a national malpractice insurance program which provides coverage only to the limit of the territorial sea in which Canada has full sovereignty (15). Thus the usual malpractice coverage is unavailable to physicians working offshore. Further, physicians providing supervision of nurse/medics working on installations outside the limit of the territorial sea are not covered (15). This is an important matter in recruiting physicians as, without medical malpractice insurance coverage they are reluctant (except in an emergency) to care for patients outside of territorial waters.

Until recently, the Association of Registered Nurses of Newfoundland (ARNN) and the Registered Nurses Association of Nova Scotia (RNANS) provided malpractice insurance to their members working in the continental shelf zone (16). The ARNN has changed its policy on nursing malpractice insurance and as of January 1, 1984, will not provide coverage for its members working outside the Province. At present, a Canadian nurse/medic working on a foreign registered offshore installation will come under the laws of the flag country in the event of malpractice.

## 2.6 ADMINISTRATIVE ARRANGEMENTS IN INDUSTRY

In many Canadian and multinational companies operating in the Canadian offshore health programs were slower to develop than safety programs, and company medical services, with rare exceptions, were administered under the aegis of personnel or safety. The duties of physicians were usually limited to conducting pre-employment assessments, offering some health care and providing advice to management, but not extending to the wider responsibility usually expected of departments of occupational and environmental medicine in industry. With one or two notable exceptions, physicians have played only a limited role at the executive and management level.

The limited management and executive role of physicians in Canadian industry differs from the situation elsewhere. In the U.K. the senior physician usually has a significant administrative position in the industry. In Norway the responsible offshore industry medical director reports directly to senior management, and the health care system permits the government to propose three candidates to the operators for the position of medical director (17). In Norway medical directors often participate in the actual provision of medical care to workers but in Canada this is impractical on the grounds of geography.

The medical directors of oil companies working in the Atlantic offshore are located in Calgary and about half are part-time employees. They have varied backgrounds in medicine and some have specialty qualifications in occupational and environmental medicine. These medical directors are chiefly responsible for health matters arising in the land drilling operations, and refineries, etc. Their involvement with the health of offshore workers may represent a minor area of responsibility as offshore drilling activity may be only a small segment of the company's business.

In almost all cases in the Atlantic area medical directors delegate the responsibility for the regional health needs of the company to one or more company physicians who are usually part-time contractual employees of the operator. Until recently most companies maintained a loose arrangement with the physician whereby he provided medical services as requested by the rig medic and performed other duties such as pre-employment assessments at the request of administrative personnel. This pattern still exists in some companies but in others the company doctor has been given more administrative responsiblity and may supervise the professional activities of one or more rig medics. A number of groups of physicians in Atlantic Canada provide coverage to contracting companies.

The medic on the rig reports administratively to the installation manager, and may work relatively autonomously, seeking consultation with the onshore physician only when he thinks it is necessary. There may be a closer relationship between the medic and the company doctor involving more frequent contact. Since in some cases medics may be employed by the operator or by the contracting company, it may be difficult to identify lines of administrative responsibility. This problem is complicated by the fact that the medic may be responsible to the operator's company physician for the health of operator's personnel and to the contractor's company physician for the health of the contractor's personnel. This arrangement can lead to confusion especially where multiple casualties are involved. The establishment of clear lines of responsibility between the operators and medical

directors, physicians and medics must be regarded as a very high priority.

In addition there is a vital need to rationalize the relationship between health and safety at all levels of the offshore operation. The rig medic, although having a prime responsibility for health care, may also have responsibility for safety and for this work he reports to a senior official responsible for safety.

## 2.7 FEDERAL AND PROVINCIAL GOVERNMENT ADMINISTRATIVE ARRANGEMENTS

In Canadian Federal and Provincial government departments, little expertise has been identified in the field of offshore medicine. Until recently there has been little communication between physicians in government and in industry, and in consequence, relevant health personnel have not been available to participate in the overall offshore developments. Advice on health matters to the regulatory agencies in Canada has tended to come from administrative and safety departments of companies rather than from occupational health departments. It appears that this deficiency will be gradually remedied as over the last few months physicians in government with expertise in occupational and environmental medicine have been providing consulting services to other government departments and an organized group of physicians and other health workers is slowly developing.

This relatively slow development in Canada contrasts sharply with the experience in the U.K. where industry was extremely active in developing health standards. In Norway health matters were identified early as being important enough to warrant the establishment of a separate directorate of offshore health which was involved in developing the detailed regulations and guidelines on health and safety.

## 2.8 SUMMARY AND CONCLUSIONS

1. Offshore health and safety jurisdictional and legal matters in Canada are significantly more complex than in the U.S., U.K. or Norway.

2. If uniformity of health care and unambiguous regulatory structures are to be achieved it will be necessary for the Federal and Provincial governments and their agencies to develop coordinated approaches.

3. By enactment of the necessary legislation the Canadian government could ensure that all Canadian and Provincial laws apply to the offshore, thereby providing for offshore workers the same level of health and safety services as are provided for workers onshore.

4. Until such enactment takes place, compliance with Federal and Provincial health and safety requirements can be incorporated in the licence arrangement with operators.

5. The operator should be fully responsible for health and safety of all workers on the MODU including contractors' and subcontractors' employees.

6. The establishment of clear lines of responsibility for health and safety and communication in industry is imperative.

7. Government departments and agencies at all levels should have active advisory groups made up of multidisciplinary health professionals and consulting expertise within government departments should be developed.

Chapter 2

## REFERENCES


1. Notes prepared on meeting between Dr. Arne Sunde and Dr. A. M. House, April 1983, Stavanger, Norway, p. 1.

2. Eidem, Inge Bjorn; "The Application and Enforcement of Health and Safety Law Offshore", The Norwegian Petroleum Directorate, Stavanger, 29.11.82, p. 21.

3. Sunde, Dr. Arne; "Report Following a Visit to The Centre for Offshore and Remote Medicine, Memorial University of Newfoundland", July 2-8, 1983, p. 3.

4. Notes prepared for Study Team meeting with Dr. Arne Sunde, Chief Medical Officer, Offshore Division, Norwegian Health Directorate, St. John's, July 4, 1983, p. 3.

5. Royal Decree July 9, 1976 relating to safe practice for the Production of Submarine Petroleum Resources. Issued pursuant to Section 3 of Act No. 12 of June , 1963, relating to Exploration for and Exploitation of Submarine Natural Resources. Section 33, p. 134, in The Continental Shelf, Norwegian Petroleum Directorate, 1.1.83.

6. Howells, Professor R.W.L.; "Occupational Health and Safety in the North Sea - British and Norwegian Comparisons: I in Health and Safety Offshore: Law and Practice, University of Aberdeen, Employment Law Studies, Criminal and Civil Law, Faculty of Law, December 7, 1982, p. 9.

7. Ibid., p. 8.

8. Gold, Edgar, Underwood, Peter C., Rolston, Susan J., McDorman, Ted L., Seymour, Geoffrey M., Letalik, Norman G.(Dalhousie Ocean Studies Program); "Safety in the Design, Construction and Operation of Offshore Oil and Gas Installations: A Comparative Analysis of the Regulatory Structures of Norway, Canada, United States and the United Kingdom", (DRAFT), Report for the Royal Commission on the "Ocean Ranger" Marine Disaster, January 1983, p. 127.

9. Ibid., p. 82 and 87.

10. Burgoyne, Dr. J.H.; "Offshore Safety", Report of the Committee, Presented to Parliament by the Secretary of State for Energy by Command of Her Majesty, London, March 1980, Section 6.6, pp. 51 and 52.

11. "First Oil Rig Workers to be Unionized", The Daily News, August 22, 1983, p.3.

12. Personal correspondence with Dr. Gordon Daugherty, Study Advisor, March 7, 1983.

13. Notes on Study Team meeting with representatives of N.S. Department of Health, Halifax, May 30, 1983.

14. Notes on Study Team meeting with representatives of the Nova Scotia Workers' Compensation Board, Halifax, May 30, 1983.

15. Personal correspondence from Newfoundland Medical Association.

16. Notes on Study Team meetings with representatives of the Association of Registered Nurses of Newfoundland, St. John's, April 28, 1983, and the Registered Nurses Association of Nova Scotia, Halifax, May 30, 1983.

17. Notes on Study Team meetings with Dr. Arne Sunde, July 4, 1983, p. 4.

18. Higginson, A.J.; "Legal Aspects of Safety, Health and Welfare on the United Kingdom Continental Shelf" in Cox, R.A.F., Offshore Medicine. Springer-Verlag, New York, 1982.

## BIBLIOGRAPHY


1. Drilling for Oil and Gas on Canada Lands; Procedures and Guidelines, Canada Oil and Gas Lands Administration, DRAFT, May 1982.

2. Canada Oil and Gas Drilling Regulations, Office Consolidation, Regulations respecting the Exploration and Drilling for the Conservation of Oil and Gas and the measures to ensure the safety of such operations, November 1980.

3. Newfoundland and Labrador Petroleum Drilling Regulations, under the Petroleum and Natural Gas Act and the Occupational Health and Safety Act, June 8, 1982.

4. The Continental Shelf, Main Acts, Regulations and Guidelines issued by Norwegian Authorities, Norwegian Petroleum Directorate, 1.1.83.

5. Hindley, Mr. B.W.; The Application and Enforcement of Health and Safety Law Offshore - The British Approach in the Health and Safety Offshore Law of Practice, Lenniner in Aberdeen, Employment Law Studies and Faculty of Law, University of Law, Aberdeen, December 7, 1982, pp. 1-10.

Chapter 3

# PRE-EMPLOYMENT MEDICAL ASSESSMENT

## 3.1 INTRODUCTION

The pre-employment medical assessment should establish a worker's medical fitness for a particular offshore job taking into account his capacity to adapt to the harsh environment, the possible long and arduous work schedules, the psychological stresses, and the uncertainty of medical evacuation or the availability of medical personnel from onshore. The worker's ability to function in case of abandonment, fire or other disaster must also be considered. Because the physical structure of an offshore installation requires an ability to negotiate confined spaces and to climb ladders there is virtually no category of "light work". Every worker will have to be medically fit to perform satisfactorily, both on the job and in an emergency situation, without risk to himself or his colleagues.

## 3.2 CURRENT PRE-EMPLOYMENT ASSESSMENT PRACTICES IN U.K., NORWAY, CANADA

In the U.K. UKOOA has developed suggested guidelines for medical standards of fitness for offshore employees. In Norway there are comprehensive pre-employment criteria designated by legislation for fixed rigs; however, the medical assessment of workers on MODUs is covered by the less stringent regulations of the Norwegian Marine Directorate. Pre-employment examinations covered under the Health Directorate must be carried out by "approved" physicians. One company in Norway uses the services of approximately twenty approved physicians.

At present in Canada pre-employment medical examinations are not standardized. Each company develops its own criteria which may vary significantly among companies. To date the industry medical directors as a group have not developed common guidelines for their examining physicians nor do they require the examining physician to have special expertise in offshore medicine.

There is a growing consensus in the North Sea area as well as in Canada that the development of a set of common guidelines is desirable not only to cover regional and national areas but to facilitate an international approach to this matter. While the concept of a medical passport has been discussed, particularly in Norway, this has not gained much support to date. The acceptance of common guidelines would, however, do much to facilitate the establishment of acceptable standards which could be applied across the industry.

With this background it is suggested that medical fitness should

be established before the employee is subjected to a strenuous and stressful basic training program and that the examining physician must have a knowledge of the conditions of work on an offshore installation.

Written standards for the medical examination and assessment cannot be comprehensive and there must be some room for clinical judgment, but any departures from the guidelines must be justifiable. The pre-employment assessment should include a careful medical history and a thorough physical examination, bearing in mind the unique requirements of the workplace. A questionnaire should be part of the assessment and workers should be clearly informed of the importance of truthful responses to all questions and the need for total disclosure of medical information. A willful attempt to provide false information should be considered grounds for dismissal.

In compiling the following suggested criteria the Study has drawn freely from the Norwegian "Regulations Concerning Medical Examination of Employees on Facilities and Installations in Connection with Production of Submarine Petroleum Resources" (1) and the "Recommended General Medical Standards of Fitness for Designated Offshore Employees" proposed by the United Kingdom Offshore Oil Association (UKOOA) Medical Advisory Committee (2).

## 3.3 THE MEDICAL EXAMINATION

The medical information derived from the examination should be considered as confidential unless the patient provides written permission for release specifying to whom the information may be released. The examining physician will produce a certificate of fitness for the employer with a copy to the worker.

The employer should be responsible for ensuring that there is a system in place to provide for regular examinations. An initial examination should be carried out and re-examination should take place, as suggested by Roythorne and White (3)(4) every three years up to the age of 40, every two years from 40 to 50, and every year after the age of 50. If medically indicated, the examining physician may recommend more frequent periodic examinations. After a significant illness or accident which requires an absence from work of more than six weeks the worker should be re-examined using the same criteria as are used in the pre-employment assessment.

Normally a urinalysis and chest X-ray or documentation of a normal chest X-ray in the previous 12 months will be required. Other X-rays, e.g. of back, should only be carried out if indicated from the examination. Additional investigations may be undertaken if the examining physician wishes to clarify the initial findings or because of the nature of the job, e.g. stool culture for caterers. There is mounting evidence to indicate that audiometry should be

carried out on all workers (2).

Normally the pre-employment examinations will be carried out by a physician approved by the medical director of the company. The medical director of the company, or his designate, should have the final responsibility for determining medical fitness to work offshore. In Norway there is a mechanism whereby a worker can appeal against the examining physician's decision regarding medical fitness.

## 3.4 CONTRAINDICATIONS FOR OFFSHORE EMPLOYEES

Certain medical conditions and forms of treatment represent a definite contraindication and others a relative contraindication to working offshore. The following list, based on body systems, is, with minor modifications, based on the suggested UKOOA guidelines (2):

### 3.4.1 REGULAR DRUG THERAPY

(i) Treatment by anticoagulants, cytotoxic agents, insulin, anticonvulsants, immunosuppressants.

(ii) Treatment by psychotropic drugs, e.g., tranquillizers, narcotics, hypnotics, are probably not acceptable. A previous history of such treatment will also require further consideration.

In general any and all prescribed medications should be reported to the rig medic and the individual should ensure that he has a supply of medications sufficient to last longer than his normal tour of duty offshore. Any subsequent change in dosage should also be reported.

### 3.4.2 CARDIOVASCULAR SYSTEM

(A) Blood and Blood Forming Organs

(i) Anaemias requiring investigation.

(ii) Leukaemia, polycythaemia and other related disorders of the reticulo-endothelial system. (See note on Malignant Disease).

(iii) Haemorrhagic disorders.

(iv) Any other disease of blood or blood forming organs which could adversely affect performance or level of consciousness.

(B) Peripheral Circulation

(i) Current thrombophlebitis, phlebothrombosis or recent history of such with or without embolization.

(ii) Arteriosclerotic or other vascular disease with evidence of circulatory embarrassment.

(C) Peripheral Oedema - Until aetiology is determined.

(D) Syncope - Recurring.

(E) Aneurysm or history of arterio-venous fistula.

(F) Heart

(i) Congenital heart disease accompanied by cardiomegaly, ECG abnormality or evidence of inadequate oxygenation.

(ii) Current clinical diagnosis of myocardial infarction, angina pectoris, coronary insufficiency, thrombosis or similar disease of a type known to be accompanied by syncope, dyspnoea, sudden collapse or heart failure.

(iii) Hypertrophy or dilatation of the heart on clinical examination, X-ray or ECG.

(iv) Arrhythmias not accompanied by organic heart disease or predictable loss of consciousness are not exclusory but should be evaluated by a cardiologist.

(v) Hypertension. Uncomplicated hypertension on medication which has maintained stability for 6 months and where there is no manifestation of treatment side-effects may be acceptable.

3.4.3 RESPIRATORY SYSTEM

(i) A pneumothorax within one year of occurrence.

(ii) Emphysema, if there is dyspnoea or cyanosis on mild exertion.

(iii) Asthma requiring frequent or recurring medication including steroids is not acceptable. A history of infantile asthma resolving in teenage is not a contraindication.

(iv) Acute/chronic infectious pulmonary disease is not acceptable until the disease is arrested or eradicated and certified so by the attending physician.

(v) Respiratory function tests should show that the Forced Vital Capacity is greater than 70% of the predicted value and the Forced Expired Volume in one second should be greater than 65% of the predicted value.

3.4.4 E.N.T.

(i) Conversational hearing in one ear and ability to hear warning devices is the minimum base line. Exposure to acoustic trauma at work has to be considered.

(ii) Disorders of the tympanic membrane and middle ear will require further assessment.

(iii) Intractable inner ear disorder with severe motion sickness, vertigo, etc.

(iv) Nasal airway obstruction sufficient to interfere with use of a respirator.

(v) Dental caries, abscess, severe gum disease until treated.

(vi) History of frequent severe recurring episodes of tonsillitis.

3.4.5 GASTROINTESTINAL SYSTEM

(i) The alimentary system should be normal with teeth and gums healthy. Dentures should be well fitting and adequate.

(ii) Digestive disorders, causing severe or recurrent symptoms requiring special diet or medication for pain, e.g. cholecystitis, inflammatory bowel disease, pancreatitis, may exclude work offshore until definitively treated and reassessed.

(iii) Peptic ulceration which has been associated with complications such as perforation, bleeding, or intractable pain should be grounds for exclusion until treated and stabilized without medication for at least six months.

(iv) Hernia is an absolute contraindication until repaired although a hiatus hernia which has been investigated may be acceptable.

(v) Haemorrhoids causing intractable pain with recurrent bleeding, prolapse, acute or chronic infection may be contraindications.

(vi) Evidence of rectal or prostatic malignancy is a contraindication.

(vii) The presence of a stoma is not acceptable.

### 3.4.6 ENDOCRINE DISEASE AND METABOLIC DISORDERS

There should be no disease of the endocrine glands.

(i) Diabetes mellitus, satisfactorily controlled by diet alone or by diet and an oral hypoglycaemic agent is not a cause for rejection. However, a history of hypoglycaemic episodes, diabetic coma or pre-coma, or insulin dependence is an absolute contraindication.

More frequent periodic medical examination and careful assessment will be required for the following:

(ii) Diabetes insipidus.

(iii) Addison's disease or syndrome.

(iv) Cushing's disease or syndrome.

(v) Hypoglycaemia, functional or due to pancreatic pathology.

(vi) Thyroid disorders.

### 3.4.7 GENITOURINARY SYSTEM

Note: Urinalysis by Labstix for glucose, protein, blood and bilirubin or similar is mandatory in the medical examination.

(i) Calculus if mobile or affecting renal function may be a contraindication until resolved, unless it is large, fixed and with no effect on renal function.

(ii) Any renal disease which could lead to acute renal failure, i.e., nephritis, nephrosis, polycystic disease, hydronephrosis or unilateral nephrectomy with disease in the remaining kidney.

(iii) History of enuresis recent or active.

(iv) Prostatitis, prostatic hypertrophy or urethral stricture interfering with complete bladder evacuation.

### 3.4.8 SPECIAL CONSIDERATIONS FOR FEMALE EMPLOYEES

Female employees should have a full obstetric and gynaecological history taking into account the need to assess the worker's health not only for the job but for ability to function without danger to herself or to others in the isolated and remote environment. Where there is uncertainty the examining physician should recommend a consultation with an obstetrical and gynaecological specialist who has adequate knowledge of the offshore workplace.

Pregnancy at the time of the pre-employment assessment is a contraindication to employment. If a worker becomes pregnant the added potential risks should be considered and discussed. In any event the worker should not work offshore after 28 weeks of pregnancy.

3.4.9 LOCOMOTOR SYSTEM

(i) There must be no deformity or amputation of body or limb which is likely to significantly reduce mobility, interfere with performance of duties or prevent compliance with evacuation procedures. A limb prosthesis may be acceptable providing the above criteria can be met.

(ii) No chronic or recurrent disease of muscles, bones or joints significantly affecting mobility, balance, coordination or ability to perform normal duties or to comply with evacuation procedures.

3.4.10 EYES

Eye disease and visual defects rendering the applicant incapable of carrying out his duties efficiently and safely are unacceptable.

(i) A monocular individual is unfit for offshore employment unless an ophthalmologist can demonstrate an appreciation of adequate depth perception. (N.B. such an individual if considered fit for offshore employment, must be advised to wear safety spectacles with side shields at all times).

(ii) Colour perception should be adequate for the type of employment to be undertaken.

(iii) Visual acuity must be at least 6/12(corrected) in the best eye. If spectacles are worn a spare pair should be taken offshore for use in the event of loss or damage.

(iv) Use of contact lenses is discouraged but may be allowed following medical clearance.

3.4.11 SKIN

(i) The skin must be healthy and there must be no communicable disease.

(ii) A history or clinical evidence of any recurrent disabling skin disease or sensitivity is contraindicated.

(iii) Any skin conditions likely to be aggravated or initiated by exposure to substances in the offshore environment such as oils, detergents or other chemicals.

### 3.4.12 NERVOUS SYSTEM

Examining doctors are asked to take account of the individual's general personality. An established medical history or clinical indication of any one of the following is grounds for rejection:

(i) Personality disorder characterized by deviant or anti-social behaviour.

(ii) Psychosis.

(iii) Alcoholism, meaning a state in which a person's intake of alcohol is sufficient to damage his physical, mental or social well being. (N.B. Episodic drinking or tranquillizer intake may precipitate epileptiform seizure on withdrawal).

(iv) Drug dependence, meaning a state in which a person is dependent upon or habituated to drugs, other than alcohol, tobacco or ordinary caffeine-containing beverages as demonstrated by use or sense of need for the drug to ensure normal functioning (e.g., barbiturates, mood modifying compounds and analgesics).

(v) A history of significant previous (illegal) drug abuse is cause for rejection and examining doctors are advised to examine likely injection sites on the patient's body.

(vi) Established medical history or diagnosis of:

(a) Epilepsy of any type.

(b) Disturbance of consciousness without satisfactory medical explanation.

(c) Any other convulsive disorder, disturbance of consciousness or neurological condition likely to render the individual unable to perform duties safely.

### 3.4.13 MALIGNANT DISEASE

Evidence of malignant disease either active or having occurred within the last 5 years may cause rejection. However with advances in treatment individuals with malignancy can work safely offshore and each case should be carefully considered on an individual basis.

### 3.4.14 DEFORMITY OR ABNORMALITY

Any deformity or other obvious physical abnormality which may cause risk to the individual or to fellow workers must be carefully considered.

Obesity, while not necessarily a contraindication to employment, should be assessed carefully bearing in mind overall agility, the ability to move in narrow spaces, the possibility of having to be winched, and the difficulty in being fitted with a survival suit.

Ideally, pre-employment medical standards should be applicable across the industry. The regulatory agency should be responsible for the determination of minimum acceptable medical standards for all offshore workers.

Even those persons who may not be regular workers but who expect to stay for several days at a time on an offshore platform must meet the medical standards of regular employees. There is no firm opinion, but the consensus seems to indicate that someone who spends more than six days offshore per year should be considered to be a regular worker.

#### Medical Examination for Fitness to Dive

Special groups such as divers, pilots, crane operators, catering staff, etc., will require additional special consideration. For example, medical examination for fitness to dive is addressed in the Draft Canada Oil and Gas Diving Regulations (5), which specify that only certain doctors with special training can be approved to carry out this examination.

The medical examination specified in these regulations is broadly similar to that currently in use in the United Kingdom and Norway, but is more extensive. The COGLA examination specifies that electronystagmography be carried out at least on initial assessment and following vestibular decompression sickness. This test assesses vestibular function and can indicate disturbance of a diver's sense of balance.

Further, divers of 35 years of age and over are required to have an exercise stress electrocardiogram. False positive results are known to occur in this test but no one suffering from ischaemic heart disease should be permitted to dive. A false positive result from this stress test can be used as the basis for undertaking more complex investigative procedures.

## REFERENCES

1. Regulations concerning medical examination of employees on facilities and installations in connection with production, etc. of submarine petroleum resources issued by the Ministry of Social Affairs August 1st, 1980 in pursuance of section 3, cf. section 31, of Royal Decree of 9th July 1976 relating to Safe Practice for Production etc. of Submarine Petroleum Resources (Unofficial translation) in "The Continental Shelf", Norwegian Petroleum Directorate, 1.1.83, pp. 203-214.

2. Medical Advisory Committee, United Kingdom Offshore Operators Association, " Recommended General Medical Standards of Fitness for Designated Offshore Employees", June 1981 pp. 1-9

3. Cox, R.A.F., "Offshore Medicine: Medical Care of Employees in the Offshore Oil Industry", Springer-Verlag, New York, 1982, pp. 34-42.

4. Roythorne, C., "Medical Fitness for Work Offshore", Proceedings from Offshore Para-Medicine Conference held in Edinburgh, 9-10 March 1983, pp. 1-6.

5. Canada Oil and Gas Diving Regulations (DRAFT), Canada Oil and Gas Lands Administration, Ottawa, Part V, pp. 56-57.

Chapter 4

# GENERAL REVIEW OF THE OFFSHORE LABOUR FORCE AND WORK ENVIRONMENT

## 4.1 INTRODUCTION

In this section health and safety factors in offshore hydrocarbon operations are discussed in the context of knowledge of the personnel involved and of the special features of the environment in which the work is carried out.

The literature is reviewed concerning the health aspects of offshore petroleum operations with particular reference to the North Sea, a zone with many similarities to the Canadian East Coast. In this review, drilling units are emphasized as standby/supply vessels do not differ from other ocean-going vessels with the exception of being required to load and unload cargo while at sea and participate in search and rescue operations.

## 4.2 THE CHARACTERISTICS OF THE OFFSHORE LABOUR FORCE

The specific features of the offshore labour force can be illustrated by a comparision of the characteristics of workers in the offshore Newfoundland and Labrador petroleum operations with those of the total Provincial male labour force(1). This comparison is presented in Table 1.

From this it is noted that offshore employees in Newfoundland and Labrador tend to be younger, are more likely to be single or separated, and more of them have post-secondary education.

These characteristics accord with the reported profile of a typical offshore worker in the U.S.A. as being(2):

> male, 20-25 years of age, with 11.5 years of schooling married in good physical condition active in sports in school, who if he stays 4-9 months is likely to stay at least 18 months.

Table 1

Profile of the Labour Force in the Offshore Newfoundland and Labrador Petroleum Operations (taken from Steel Island Report)

| | | Offshore Labour Force (percentages) | Total Provincial Male Labour Force (all professions) (percentages) |
|---|---|---|---|
| AGE | 18-30 | 57 | 43 |
| | 31-40 | 29 | 25 |
| | 41+ | 14 | 32 |
| MARITAL STATUS | Single | 34 | 27 |
| | Married | 59 | 71 |
| | Divorced/ separated | 8 | 2 |
| NUMBER OF CHILDREN FOR THOSE MARRIED | 0 | 24 | no information given |
| | 1 | 23 | |
| | 2 | 30 | |
| | 3+ | 23 | |
| EDUCATIONAL ATTAINMENT | Grade 1-10 | 20 | 59 |
| | Grade 11-13 | 30 | 9 |
| | Trade or vocational school | 24 | 17 |
| | University incomplete | 13 | 7 |
| | University complete | 13 | 8 |

### 4.2.1 CREW OF A DRILLING UNIT

The workforce on a drilling unit consists of the drilling crew and the marine crew. The personnel making up the former are two toolpushers, two drillers, two assistant drillers, two derrick hands, eight roughnecks, and eight roustabouts.

The marine crew consists of a master, a first mate, a chief engineer, a mechanic, two electricians, two ballast control operators, two welders, a radio operator, two motormen/crane operators and one storekeeper.

In addition there may be specialist and support workers consisting of cementing personnel, mud engineers, testers, caterers, and personnel with other technical and professional skills. The total complement of a drill unit is approximately 80 to 90 people.

### 4.2.2 CREW OF A STANDBY/SUPPLY VESSEL

The workforce on a standby/supply vessel usually consists of eight seamen, two oilers, three engineers, two mates, a master, bosun, and two caterers, a total of approximately 17 people.

## 4.3 THE LIVING ENVIRONMENT

The employee engaged in offshore work has a style of living which has features common to those of a submariner or a member of a scientific expedition who elects to spend several months on a polar station. A body of knowledge has been developed of the needs experienced by such individuals and has been applied to offshore petroleum operations.

In consequence there is a consensus in the industry that the following features should be incorporated in the operational environment:-

i) the provision of opportunities for physical recreational activity such as the installation of containerized gymnasia

ii) the provision of a well balanced, well cooked and well presented diet with as much variation and interest as possible

iii) high standards of personal hygiene and cleanliness in the living quarters. Outbreaks of infections such as scabies and pediculosis may be a warning signal of low morale, overcrowding, poor living conditions and difficulties in practicing proper hygienic habits

iv) provision of recreational areas for discussions, for watching videos, for reading and for private study, as many employees use their leisure hours offshore for studying

v) strict adherence to systems of safety procedures and to regular and varied emergency exercises in order to instill a sense of security and confidence in the workforce

vi) provision of proper clothing

vii) protection of the employee from adverse environment factors such as noise, fumes, industrial pollutants, extremes of temperature and stress.

These features and their effect on the health of the workers are now discussed in more detail, using standards developed from experience with the North Sea oil rigs. The portions of Canadian and Newfoundland legislation pertaining to the health aspects of offshore oil development are outlined in Appendix 4-A.

### 4.3.1 VENTILATION AND HEATING

The air conditioning system should provide air of adequate temperature. In the Norwegian Sector of the North Sea, a minimum of 20'C is required (3). Humidification must also be available to prevent drying of the mucous membranes which can lead to haemorrhagic rhinitis as well as a predisposition to respiratory infections (4). Further, the system should not permit the circulation of dust or unpleasant odors from the kitchen into the living accommodations (5).

### 4.3.2 SLEEPING QUARTERS

In newer Norwegian installations the trend seems to be moving away from providing cabins of four to six bunks to two or even one bunk per cabin. Those who share a cabin should be working on the same shift so that no one's sleep is interrupted and those on 24-hour call should have individual sleeping quarters. Cabins should be constructed to be aesthetically pleasing and easily cleaned. Change of bed linen with each occupancy is important to prevent the spread of scabies and other infections. When outbreaks of scabies do occur, as happened recently on the Scotian Shelf, all bedding has to be deinfested. Norwegian regulations provide specifications for bed linen and frequency of changes.

Each cabin should have its own adjacent toilet, hand basin and shower facilities with regulating devices to maintain a selected water temperature. In recent years there has been increasing awareness of the need to ensure that shower curtains are permitted to dry after showers, since damp curtains can become a nidus for the growth of fungi-producing spores which may cause a respiratory allergy.

### 4.3.3 RECREATIONAL AREAS

There should be several rooms of this type such as a cinema, a lounge for talking and smoking and another where those who wish to be alone can read or listen to cassettes. Some of the newer Norwegian rigs provide saunas, swimming pools and gymnasia, the aim being to maintain the physical fitness of the workforce, and help prevent obesity. Recreational areas should be capable of being put to a number of different uses. For example, in an emergency a recreational area might be the most convenient location for receiving and sorting a large number of casualties. To permit this usage the sick bay should be adjacent and accessible to a recreation area, preferably devoted to quiet pursuits.

### 4.3.4 SICK BAY

The sick bay is managed by an offshore nurse or rig medic who will normally see one or two casualties or ill patients at a time. For routine purposes the sick bay need not be large, but if there is a serious accident there may be a rapid influx of a large number of casualties. The requirements for the sick bay are discussed in more detail in section 7.2.

### 4.3.5. CORRIDORS

All corridors on the drilling unit should be accessible and safe, i.e. well ventilated, well illuminated with backup emergency lighting for escape exits, provided with smoke detectors and fire extinguishers and not used for storage.

### 4.3.6. LAUNDRY FACILITIES

The laundry facilities should be adequate to provide for the hygienic handling of all personal clothing and bed linen for the full complement of crew.

### 4.3.7. CATERING AND EATING QUARTERS

It is essential to provide food of good quality and taste, prepared hygienically and consumed in hygienic and aesthetically pleasing quarters.

In Northern latitudes the state of nutrition is a key factor in the body's ability to cope with cold. Surface fat is a good insulator but to be overweight is to be less agile. Thus, a diet that causes excess subcutaneous fat to be laid down may not be consistent with the most efficient performance at work.

A considerable number of investigations are currently being undertaken on the dietary needs of a work force in cold climates, including ways to achieve balance between requirements for

adaptation to cold and work efficiency (6).

Education on proper dietary habits should be part of the orientation program for offshore workers and the catering service should be flexible enough to respond to increasing requests by individuals for items such as salad, whole wheat bread, fresh fruit and polyunsaturated margarine (7). In addition, to accommodate the shift system, the catering service must be flexible enough to offer breakfast, dinner and supper at any one time.

To safeguard food from spoiling or from contamination by toxins or micro-organisms, minute attention has to be paid to all aspects of the selection, transportation and storage of food. High standards must be established and maintained in the preparation of food, involving the cleanliness of the quarters in which it is prepared and served and the health and hygiene of those who handle, prepare and serve meals. A detailed description of hygienic catering is provided by Chalk (7).

The Norwegian legislation regulates offshore food catering but in the United Kingdom, public health authority ends at the shore line. To meet the special catering needs of the U.K. offshore sector, a medical subcommittee of UK Offshore Operators Association commissioned The Institute of Environmental and Offshore Medicine of Aberdeen to prepare a system of environmental health guidelines which would ensure high standards of environmental health for the offshore industry, and which would be acceptable to industry and to appropriate government departments(4)(8).

These requirements were eventually achieved. Provisions were made for voluntary periodic monitoring by inspection of offshore structures with private reporting of findings to the companies. In addition, educational programs were developed consisting of courses in environmental health and food handling for offshore management, catering personnel and rig medics. To date the success of these environmental health guidelines in the U.K. sector of the North Sea has been demonstrated by the fact that there has not been a serious outbreak of food infection for the past five years. Bustin (8) discusses at length the safeguards required in food handling, catering and the provision of potable water.

### 4.3.8. POTABLE WATER

On the Canadian East Coast drinking water is prepared by desalinating sea water followed by chlorination and storage. Problems may arise if the intake for the potable water system is located close to the sewage disposal pipe or becomes contaminated with industrial pollutants. Another problem of storage is leaching of toxic chemicals such as epoxy resins from the storage

tank lining into the stored water.

Providing a safe and adequate potable water supply involves regular monitoring of the quality (pH and chemical content) of the water, and testing for contamination by toxins or micro-organisms. Storage tanks should be equipped with a divider so that if a structural fault develops only one part need be emptied.

In addition, potable water requires protection, both from freezing and from high temperatures (solar and artificial). Norwegian regulations (9) specify the standards for potable water.

4.3.9. WASTE DISPOSAL

Waste is collected in skips which are sent ashore to be emptied. To prevent infestation with insects and rodents these skips should be routinely cleansed before being returned to the installation (8).

4.3.10. PROTECTIVE CLOTHING (EXCLUSIVE OF SURVIVAL SUITS)

There has been much discussion concerning protective clothing over the years but a definitive answer to the design problem is not yet available. Protective clothing has not been designed which is wind- and water-resistant yet does not hamper the employee in the performance of his tasks (10). The design requirements for such clothing are discussed by Manson (11).

## 4.4 THE PHYSICAL ENVIRONMENT AND ITS HAZARDS

4.4.1. THERMAL FACTORS

On the Canadian East Coast the problems of workers appear most likely to be associated with environmental cold. On totally open installations personnel could be subject to a gradual and slow reduction in body temperature with insidious physiological and psychological effects (10). Whether or not the brain is directly affected by minor degrees of body cooling, it seems likely that discomfort and distraction produced by exposure to cold will be associated with reduced competence and judgment and an increased incidence of accidents.

In this connection it is significant that in the North Sea the reported incidence of accidents in drilling personnel (who work in exposed conditions) is five times greater than for any other occupational group in the offshore.

Hypothermia is an extreme and life threatening consequence of exposure to cold which occurs when a person is caught out in severe cold weather conditions and is unable to seek shelter (Manson, (11)). Survival then, is a matter of being in a good physical condition, a good state of nutrition, wearing proper clothing and being psychologically capable of taking the necessary measures to protect oneself. However the procedures needed to protect oneself against the extremes of hypothermia also apply to

less severe levels of cold encountered on a windy, chilly, open installation on the Canadian East Coast. The nature of hypothermia and the measures for protection should be explained to all workers likely to encounter these conditions.

Other problems associated with exposure to cold are cold headaches (12), frostbite and the precipitation of attacks of Raynaud's phenomena (a condition referred to as white finger due to spasm of the blood vessels in the fingers caused by exposure to cold and which affects manual dexterity.) It is important to identify prospective employees who may have this latter condition because they should not be employed in locations where they are likely to be exposed to cold.

In the totally closed work site the problem of hypothermia can be reduced to a minimum or may not exist. At the other extreme, problems may arise from excessive heat, and from poor ventilation allowing the accumulation of fumes from the exhaust of diesel engines. These conditions can provide serious hazards to health, can lead to inattention, and contribute to accidents. On several platforms in the North Sea the main hazard from the thermal factors has been reported as hyperthermia rather than hypothermia.

### 4.4.2. STATE OF THE SEA

"Motion sickness" is the direct effect of wave action on the health of the offshore employees. While naturally more frequent on drilling ships and standby/supply vessels it also occurs on semi-submersibles during a poor sea state. Mild seasickness is reported to be a common occurrence on the Canadian East Coast offshore. A detailed discussion of motion sickness is presented in section 7.6.2(e).

### 4.4.3. NOISE AND VIBRATION

At the production phase of the operation there are certain areas of offshore structures which are particularly noisy and subject to vibration, for example, the pump room associated with the collection from well heads, or the various parts of the gas processing system, if there is an associated gas plant. In recent years there is increased awareness that exposure to noise produces temporary or permanent hearing defects, depending on the intensity and type of noise, duration of exposure, frequency of exposure and the intervals between exposure. Further long term studies are required to evaluate the significance of each of these variables. Unfortunately industrial deafness, once contracted, is not readily remedied.

In addition to the recognized effects of high intensity, long duration noise, "nuisance noise" refers to the psycho-social effects of noise below the dangerous threshold level which can make conversation difficult and may impede hearing spoken

instructions or warning signals. This "nuisance noise" has been attributed as a cause for sleeplessness, irritability, headaches and inability to concentrate. Exposure to noise of high intensity can interfere with bodily mechanisms for maintaining equilibrium and may thus impair a worker's ability to perform tasks. The 24-hour nature of operations offshore implies a continuous exposure to a degree of noise and a consequent possible interruption of sleep.

In addition to being a source of considerable personal, social and professional disability, noise in the offshore environment is a safety hazard since it may prevent workers from hearing operating instructions, emergency evacuation warnings or warnings indicating an escape of gas or other toxic substances.

Considerable noise and vibration are associated with helicopter travel. Thus medical teams attending offshore incidents or emergencies and exposed to the noise and vibration of the helicopter may experience fatigue which can result in inattention and loss of competence and judgement.

A. CONTROL OF NOISE

The factors which have made it possible to attack the problem of the effects of noise at any work site are:-

a) the technical ability to measure, record and analyze noise levels

b) the establishment of statistically significant and well correlated links between noise exposure and hearing loss

c) the rise in public awareness of noise as a nuisance and a danger. Such developments have led to the establishment of permissible levels of noise and exposure times, in industry by regulatory agencies.

Noise studies have been carried out extensively in offshore structures in the North Sea by the companies themselves. From these studies recommended noise limits for U.K. offshore installations have been determined and are given in Table 2.

TABLE 2 RECOMMENDED NOISE LIMITS ON UK OFFSHORE INSTALLATIONS FOR A 12 HOUR SHIFT

| | |
|---|---|
| General working areas (outside) | 88 dBA |
| General working areas (inside) e.g., stores and workshops | 70 dBA |
| Kitchens, toilets, laundries, etc. | 60 dBA |
| Offices, mess rooms, control rooms | 55 dBA |
| Recreation areas | 50 dBA |
| Quiet rooms, e.g. radio rooms, conference rooms, sleeping areas, sick bays | 45 dBA |

SOURCE: Offshore Medicine, Medical Care of Employees in the Offshore Oil Industry, R. A. F. Cox.

In the U.K. the Health and Safety executive have defined a limit of 90 dBA for an 8-hour work shift but this is considered unacceptable by some authorities, because, over time, it will still allow 11% of exposed workers to suffer a hearing handicap. In order to reduce this figure to 1% Gee (13) suggests that a limit of 75 dBA would be required.

Noise control or abatement must begin at the concept stage, i.e. the design of the rig, the choice of materials used in rig construction, the location of non-working areas, the noise and vibration qualities of the machines to be installed and how these qualities will be affected by the location of the machinery.

The U.K. offshore regulations require that every item capable of causing noise and vibration to a level likely to be injurious to health must be suitably insulated (14). Further, sufficient protective equipment including ear protectors must be provided for all persons engaged in noisy operations.

Noise levels in various parts of a plant should be measured at frequent intervals, such as every two years or when new equipment is installed, in order to assess the degree of exposure and the efficiency of any measures taken to reduce exposure to noise. The levels of noise over the years could be monitored by such periodic surveys, which should be required by law.

Employees should be provided regularly with the information, instruction and training necessary to ensure that they are aware of the risks to their hearing from exposure to excessive noise levels and to encourage them to take precautions and to adhere to procedures which will minimize the risks.

### 4.4.4 ILLUMINATION

Proper illumination is required in all areas of the installation, both to enable work to be performed efficiently and safely and in

all gangways, corridors and catwalks to prevent accidents (15). Backup lighting systems are necessary in case of emergencies to provide illumination for escape exits and to identify key locations. Regulations for the Norwegian section of the North Sea provide standards for artificial illumination for living areas (3).

4.4.5. DUST

Industrial dust is not a major problem on the rigs except for those employees engaged in specific tasks such as sandblasting.

4.4.6. RADIATION

Radiation sources are present in instruments used in seismic exploration and in mud density control. These instruments are supplied and operated by subcontractors licenced by the Atomic Energy Control Regulations of Canada. No accidents involving radiation have been reported.

## 4.5 HAZARDS OF GASES AND OTHER TOXIC SUBSTANCES

The possibility is always present that offshore workers may be exposed to toxic fumes and gases which may emanate from drill muds or from the other toxic chemicals used in the operations, or from the exhaust gases of engines used in enclosed spaces. Hazards may also arise from leaks of associated gases from the oil produced. Thus it is important to identify the types of gas that may be encountered offshore and to stress the crucial first aid measures that must be promptly instituted if life is to be saved.

4.5.1. HYDROGEN SULPHIDE ($H_2S$)

The most hazardous gas present in petroleum operations is hydrogen sulphide (sour gas) which has been detected in the petroleum deposits of the Scotian Shelf but has not yet been detected to a significant extent off the coast of Newfoundland. However it is prudent to assume that it may be present and to have a program in place for coping with the consequences of the unintentional release of dangerous volumes of this gas.

At very low concentrations (less than 0.1 parts per million (ppm)) hydrogen sulphide imparts a smell of rotten eggs to the atmosphere but there is no evidence that exposure to such low concentrations of the gas produces long term health hazards. As the concentration of hydrogen sulphide rises the sense of smell is lost but the eyes and throat are irritated thus providing a warning signal. When a very high concentration of hydrogen sulphide is reached (greater than 1,000 ppm) the gas exerts a toxic action on the respiratory centre in the brain, so that after a breath or two there is respiratory paralysis. Unless the subject is removed from the $H_2S$ atmosphere and resuscitated

immediately it is likely that he will die in 3-5 minutes. On the other hand, swift and rapid removal of the gassed subject and the institution of competent respiratory resuscitation should result in the recovery with no residual effects.

Gassing with hydrogen sulphide in the oil and gas industry may be an insidious event due to a small leak of gas directed towards an air intake, or from the slow accumulation of gas in a closed space which is entered only occasionally. On the other hand, gassing can be a sudden and disastrous event associated with a blowout when a gas cloud may settle around the whole installation.

In both of these instances lives can only be saved by urgent action. Since an unconscious worker may be found by another on his own the whole installation may be put at risk if the intending rescuer does not know what to do and in what order.

There is a well documented accident in Oman where an employee gassed with $H_2S$ was found unconscious in a low space by a colleague. The rescuer himself became gassed and started off a chain in which others who discovered the victim and his attempted rescuers themselves became unconscious. It was only when there were eight unconscious men that the ninth obtained a breathing set and successfully removed them from the toxic atmosphere. This accident serves to illustrate the necessity of training all workers in the oil and gas industry in the procedures to be taken following a gassing accident and the management of the gassed victim, while ensuring their own safety. In addition, failure to take the required first action, which was to sound the alarm, could have resulted in the continuation of the gas leak leading to a major disaster situation.

It is not sufficient to require that workers in the oil and gas industry should be given $H_2S$ training only in areas where there are sour gas wells. Many offshore oil installations are eventually associated with gas plants and in any event a blowout may suddenly be associated with a gas cloud which contains $H_2S$ without warning. To ensure the health and safety of the personnel of this industry it seems clear that all should be trained in the procedures to be adopted in the event of an escape of gas and the management of any resultant casualties caused.

### 4.5.2. METHANE (NATURAL GAS)

Although natural gas is toxic when ingested, it only becomes a health hazard if it is inhaled at high concentrations. It is a recognized fire hazard but otherwise should not present any major health problem to the Canadian East Coast.

### 4.5.3. CARBON MONOXIDE (FUMES)

Breathing carbon monoxide is a health hazard arising from the operation of internal combustion engines and adequate extraction and ventilation is necessary in areas where carbon monoxide is generated by the operations of machinery. As the level of carbon monoxide rises the victim's intellectual functions are dulled and eventually coma ensues. Exposure to high levels of this gas is

lethal, but at lower levels of exposure it may be responsible for accidents and reduced efficiency at work because of impaired intellectual functions.

4.5.4. DRILLING MUDS

A number of constituents are used in drilling muds, some of which are kept secret by the manufacturing companies. The basic components are bentonite, barium sulphate, water, oil, chemicals, asbestos fibres, cellulose polymers, diatomaceous earth and various caustic and corrosive materials (16). The only known health problem caused by exposure to drill mud are dermatitis and eye irritation.

In Norway regulations require that operators be informed of the constituents of drill mud by the supplier and unless this is forthcoming the operator is debarred from purchasing the product.

4.5.5. HYDROCARBONS

Hydrocarbons themselves may produce serious immediate effects when swallowed or ingested, but increasing attention is being paid to the effects of long term exposure to crude petroleum oil products. Several studies of workers in oil refineries have suggested that the risk of cancers of the lungs and of gastro-intestinal tract is increased, however other studies did not confirm this observation (17, 18, 19, 20, 21). The fact that smoking is forbidden in refineries should reduce susceptibility to cancer of the lungs.

Much useful information on health hazards would be obtained if it were possible to follow offshore employees through the health system in later years to determine whether the incidence of certain types of tumors or other diseases were higher than expected. Such a study would be a long term project and would depend upon liaison with the health care systems of other provinces and with provincial cancer registries.

## 4.6 PSYCHOLOGICAL AND PSYCHIATRIC PROBLEMS

The offshore installation is an isolated and artificial environment which can be viewed as an industrial workplace, a mine, a ship, an island, a heliport, a hospital, a dormitory, a recreation centre, a dock, a diving staging area, and a set of administrative offices. Those who live and work in this confined community have different backgrounds, yet at the same time share much in common, particularly in times of stress. Workers are constantly under pressure to produce and excel in their particular areas of responsibility.

Given this setting, it might be expected that the rates of stress disorders and psychiatric illnesses would be high and that in addition to the distress and loss of efficiency experienced by the patient, there would be an added risk of endangering the safety of others. Suicides have occurred in the Atlantic offshore and major psychiatric disorders and significant neurotic illnesses have been reported. However, reliable data is not yet available from which to assess whether the incidence of these conditions is higher than would be expected in a comparable group in a more conventional setting.

### 4.6.1 SOURCES OF STRESS

From interviews with workers in the Atlantic offshore, the following sources of stress were identified:

a) Onshore

i. concern for the family and problems of leaving home

ii. drug and alcohol abuse, a consequence of affluence, and the long leisure time onshore.

b) Travel

i. travel to the rig in adverse weather conditions by helicopter.

c. Offshore

i. noise

ii. limited personal space

iii. sleep difficulties

iv. anxiety for the safety of the drilling unit

v. anxiety about job security

vi. concerns about family.

This list is similar to that reported for a group of Norwegian workers(22).

### 4.6.2 OFFSETTING ADVANTAGES

To counter these reported sources of stress, many workers recognize a number of positive factors in working offshore, including:

i. good wages

ii. long periods ashore with family

iii. good living conditions offshore

iv. good health services offshore

v. restriction on alcohol and smoking

vi. low risk of unemployment

vii. specific job satisfaction

viii. opportunity for advancement

### 4.6.3 REACTIONS TO STRESS

To understand stress reactions, it is important to identify not only the factors in the environment which could impose stress, but also the personal characteristics of the individual.

To some extent, self-selection occurs. Discussion with the senior staff of oil companies in the North Sea indicated that the original large turn-over of personnel has now been significantly reduced as only those employees remain who have the personal qualities to adapt to the required life style. In the relatively newer operations off Newfoundland, this self-selection process may not have begun and weight should be placed on the process of personnel selection.

For the moment, the relevance of personal factors to the reaction to stress must be related, on the one hand to the expectation that a group composed of predominantly healthy young males should not be unduly prone to stress-related disorders, and on the other hand to the realization that some proportion of those workers will be casual or peripatetic men who, by accident or intent, are not settled in job or home.

Personal instability of a worker or his over-reaction to stress is a matter of both health and safety. The expectation is that someone with difficulties in coping with stress in the everyday situation will be unable to respond to super-added stress. Under conditions of emergency, such an individual may become a liability due to his impaired efficiency.

It is therefore important to identify these workers who have shown signficant adverse reactions to stress or have suffered from psychiatric disorders at the pre-employment examination. Apart from their direct effects on the patient, the adverse effects of psychiatric illness on the family must be considered.

### 4.6.4 CONCERNS ABOUT FAMILY

The workers identified their concerns about family as being a significant source of stress both onshore and offshore. On this basis, it might be expected that they considered their intermittent absences on the rigs to be potentially disruptive of family life and unity, and that their concerns about an unhappy or unstable wife could impair their functions offshore. Somewhat surprisingly, a sample of workers interviewed in Aberdeen reported that far from causing problems with marriage or family life, their intermittent absences suited their circumstances and were means of stabilizing personal relationships.

Morrice, et al, (23) in Aberdeen, pointed out that the 'intermittent husband' syndrome was traditional in small fishing communities and that problems that arose during the absence of the husband were dealt with on the basis of the support of the extended family and the community. While this indicates that for a family the 'intermittent husband' need not be a major problem, the necessary community or family support is not necessarily available in the relatively new situations in the offshore oil industry where families may have moved away from the support of relatives and may not be assimilated in their new communities.

### 4.6.5 PSYCHIATRIC DISORDERS

From Norwegian reports, only 3% of one work force were noted to have sought medical help for psychiatric conditions, a smaller proportion than would be found attending a family practice clinic (24). This could suggest that offshore oil workers enjoy robust mental health despite the stresses. However, the figures may be misleading as those who are identified may represent only a small proportion of those having problems. The risk of losing employment could deter a worker from reporting sick with a condition that might have psychiatric implications. Further, workers with psychiatric problems who come to the attention of management may be quietly and conveniently not invited back to the job.

The following psychiatric disorders have been reported:

i. Alcoholism. A report on psychiatric disorders in offshore workers treated at the Ross Clinic in Aberdeen indicated that alcoholism is the most frequent reason for seeking psychiatric help (25). This finding agrees with observations on workers on the Canadian East Coast offshore. The Norwegian studies suggest that there is a group of workers who can be identified as having problems with alcohol abuse when onshore and undergoing the process of detoxification offshore (26). The reduction of mental and physical abilities in such workers creates a potential hazard, and a higher risk of accidents has been attributed to such workers. Again, from local observation, alcoholics form the largest group of psychiatric patients who find employment offshore.

ii. Sleep Disturbance. Estimates of the incidence of sleep disorder vary. In one study, only 1% of workers were reported to have sought help when on the rig for sleep problems (25). However, the reported frequency of sleep disturbances ranged from 10% (27) to 29% (28) in another study, and 6% of workers admit to using sleeping pills. Systematic studies of the incidence of sleep disorders are difficult to conduct because of the subjective nature of the complaint.

iii. Anxiety and Depression. Psychoneurotic disorders represented the second most frequent reason for seeking psychiatric treatment in the Aberdeen study (25). The frequency of those seeking help offshore with these conditions was 1.5%. However 6% of the workers were reported to be taking tranquillizers, 10% had symptoms of depression and 10% complained of difficulties in adjusting to the living conditions offshore (28).

iv. Major Psychiatric Disorder. While anecdotal evidence is available, there is no statistical evidence that these conditions have a significant presence offshore. Locally, two incidents of severe mental illness, schizophrenia, were noted in workers in responsible positions. These cases represented a significant risk and as both workers had been psychiatrically ill previously, the adequacy of pre-employment medical screening can be questioned.

## 4.7 CONCLUSION

The environmental needs for offshore petroleum operations in temperate and cold latitudes are:-

1. The provision of a living environment that is clean, warm, well humidified and ventilated, free from noise and pollutants, adequately illuminated and aesthetically pleasing.

2. To provide for the necessities for proper personal hygiene.

3. To provide for recreational areas for different personal needs.

4. To provide for proper facilities for handling patients on a routine basis with the capablity to expand to adjacent areas to cope with emergency numbers.

5. The provision of safe, good quality, potable water and a diet appropriate to the environment, hygienically prepared, pleasing to the taste and consumed in hygienic and pleasant surroundings.

6. In the working place:-
   a. to protect from adverse climatic conditions
   b. to protect from industrial toxins
   c. to provide a safe milieu
   d. to prevent outbreaks of infections
   e. to minimize stresses and strains
   f. to prevent exposure to hazards with short term and long term detrimental effects.

7. To educate personnel on health hazards and emergency procedures.

8. In addition, further research is required on a number of crucial points:-

   a. long term effects of noise
   b. diet appropriate to the climatic conditions of the region and the type of work
   c. long term effects on health of exposure to hydrocarbons and its by products
   d. the incidence of stress-related disorders
   e. the relevance of personal characteristics in adapting to offshore conditions

   To conduct the necessary research, long term studies would have to be planned and the cooperation of health and other agencies, the workers and their families and the companies would be required. Given the present likelihood of increased activity in the industry in the Atlantic area and the significance of the findings both for the personnel selection process and for planning aspects of health and safety, the

research should be initiated shortly.

## REFERENCES


1. "The Steel Island, Rural Resident Participation in the Exploration Phase of the Oil and Gas Industry", Newfoundland and Labrador, 1981. Research and Analysis Division, Department of Rural, Agricultural and Northern Development, Government of Newfoundland and Labrador, p.54.

2. "Safety and Offshore Oil"; National Academy Press, Washington, D.C., Committee on Assessment of Safety of OCS Activities, Marine Board of Engineering National Research Council, 1981, p. 235.

3. Royal Decree 25th November 1977 Relating to Hygiene, Medical Equipment and Medicines, etc., on installations for production, etc. of submarine petroleum resources issued pursuant to Section 3 of Act No. 12 of the 21st June, 1963, relating to Exploration for the Exploitation of Submarine Natural Resources, cfr. Royal Decree of July 9, 1976 relating to Safe Practices (unofficial translation) (Norway), p. 165.

4. Linning, M.M.; Talk Given at Symposium on the Environmental and Occupational Medicine Aspects of Offshore Oil and Gas Exploration and Production, May 25, 1981, p. 16.

5. Potter, N; "Drafting New North Sea Ventilation Standards", North Sea Observer, No. 11/12, 1981, p. 16.

6. "Safety Problems in the Offshore Petroleum Industry", International Labour Office, Genveva, 1978, p. 19.

7. Chalk, N.; "Catering and Hygiene" (Chapter 8) in Cox, R.A.F.; Offshore Medicine, Medical Care of Employees in the Offshore Oil Industry, Springer-Verlag, 1982.

8. Bustin, H.E.; "Environmental Health Requirements on Offshore Oil and Gas Exploration and Production Installations", in Symposium on Occupational Health and Safety of Workers in the Petroleum Extractive Industry, Luxembourg, April 19 and 20, 1983, p. 97-99.

9. Supplementary regulations covering requirements concerning potable water systems on installations for production, etc. of submarine petroleum resources, with guidelines for disinfection of potable water. Issued by the Ministry of Social Affairs on 23 October 1978 in pursuance of Section 26, cfr. equipment, medicines, etc. on installations for production etc. of submarine petroleum resources (unofficial translation) (Norway), pp. 217-222.

10. Cox, R.A.F.; "Offshore Medicine, Medical Care of Employees in the Offshore Oil Industry", Springer-Verlag, New York, 1982, Chapter 6.

11. Manson, H.J.; "Hypothermia", Related Papers for the Occupational Health and Safety and Related Matters Study, November 1983.

12. Bell, C.R.; "Headaches Associated with Cold-Exposure: A Preliminary Survey of Expert Opinion", Report prepared for the Environment Subcommittee, Royal Naval Personnel Research Committee, 1977, pp. 1-7.

13. Gee, D; "Summary of GMWU Comments on the Draft HSE Noise Regulations"; The Trade Union Viewpoint, pp. 1-2.

14. Code of Practices for Reducing Exposure of Employed Persons to Noise, HMSO 1976.

15. North Sea Observer, No. 11/12, 1981, p. 17.

16. Boucheny, L.; "The Risk of Accident in the Oil and Gas Extractive Industries Onshore", EEC Symposium on Occupational Health and Safety of Workers in the Petroleum Extractive Industry, Luxembourg, April 19 and 20, 1983, p. 4.

17. Gottlieb, MD.; "Lung Cancer and the Petroleum Industry in Louisiana", Journal of Occupational Medicine, Vol. 22, 6, June 1980, pp. 384-388.

18. Theriault, G., Goulet, L.; "A Mortality Study of Oil Refinery Workers", Journal of Occupational Medicine, Vol. 21, May 1979, pp. 367-370.

19. Rushton, L., Alderson, M.R.; "An Epidemiologic Survey of Eight Refineries in Britain", British Journal of Industrial Medicine, 1981, 38:225-234, pp. 225-234.

20. Thomas, T.L.; Waxweiler, R.J.; Moure-Eraso, R.; Itaya, S.; Fraumeni, J.F.; "Mortality Patterns Among Workers in Three Texas Oil Refineries", Journal of Occupational Medicine, Vol. 24, Feb. 1982, pp. 135-174.

21. Hanis, N.M.; Stavraky, K.M.; Fowler, J.L.; "Cancer Mortality in Oil Refinery Workers", Journal of Occupational Medicine, Vol. 21, No. 3, March 1979, pp. 167-174.

22. Hellesoy, O.H., Gogstad, A. Chr., "A provisional, informative study of expectations, attitudes and experience from the work at the Statfjord Field as expressed by some of the employees during the summer of 1979", Mobil Exploration Norway Inc. December, 1979, pp. 37 and 39.

23. Morrice, Dr. J.K.W., Taylor, Dr. R.C., Clark, D.,

"Intermittent Husband Absense: Proposal for a Comparative Study of Wives Coping Behavior in Four Occupational Groups". pp. 1-2.

24. Moss, L.M., Milcarek, B.I., Hellesoy, O.H., "EVALUATION OF OFFSHORE HEALTH SERVICES" I. Illness and accidents offshore.e Mobil Exploration Norway Inc., August 1981.

25. Olley, P., "Psychiatric Problems in the North Sea Oil Industry, Scottish Medical Journal 1982, Vol. 27, pp. 361-2.

26. Moss, L.M., Hellesoy, O.H., Milcarek, B.I. "EVALUATION OF OFFSHORE HEALTH SERVICES", III. Groups at Risk for Health and Well-being Problems and occupational injuries. Mobil Exploration Norway Inc., January 1982.

27. Moss, L.M., Milcarek, B.I., Hellesoy, O.H., "EVALUATION OF OFFSHORE HEALTH SERVICES", II. Patterns of use of health services. Mobil Exploration Norway Inc., August 1981.

28. Hellesoy, O.H., Milcarek, B.I., Moss, L.M., "STATFJORD °A°: A PLACE OF OFFSHORE EMPLOYMENT", Examining issues raised in previous Norwegian research reports. Volume 2. Examining issues raised in the Work Research Institutes° papers. Mobil Exploration Norway Inc. December 1981.

Chapter 5

# THE INCIDENCE OF ILLNESSES IN THE CANADIAN EAST COAST PETROLEUM OPERATIONS

## 5.1. INTRODUCTION

The work force engaged in the drilling units and standby/supply vessels is composed mainly of young males who, by selection at hiring, represent a potentially healthy population. Even in such a healthy young group a certain number of illnesses will occur, some of which can be related to the unusual conditions under which they work.

In some cases, the diagnosis, treatment and management of the offshore patient can be carried out completely on the rig. In other, generally more severe disorders, evacuation for referral to a health agency on shore may be required.

## 5.2 TYPES OF ILLNESS

The following general categories of illness can be expected to arise:

### 5.2.1. OFFSHORE INFECTION

The Canadian East Coast offshore workforce's 3-week isolation period is not long enough for workers to become highly susceptible to intercurrent respiratory infections. Isolated cases have occurred of sexually transmitted diseases contracted on shore, and treatment is continued by the offshore medic. There have also been occasional outbreaks of scabies.

In the North Sea there have been outbreaks of dysentery, hepatitis and food poisoning (1) and scabies (2). Since drill units move back and forth from temperate to tropical zones isolated cases of tropical diseases arise (3).

Operators in the North Sea have recognized that the transmission of infection in an overcrowded offshore community may have disastrous consequences, at the worst requiring closure of operations. On shore public health authorities have cautioned that uncontrolled evacuation of contacts could lead to wide dissemination of an infection on shore.

### 5.2.2. OTHER ILLNESSES

Non-infectious diseases are not a significant problem offshore since pre-employment screening will have rejected applicants with serious conditions. However as time passes and the production phase is reached the workforce will be older and more stable. The

diseases arising from degenerative processes typical of the age group 40+ will then begin to appear. e.g., low back pain, cancers, vascular degeneration.

5.2.3 DENTAL DISORDERS

Dental problems are one of the more common reasons for medical evacuations. Therefore at the pre-employment and annual examination particular attention should be paid to common problems such as dental caries, loose fillings and periodontal disease, which should be corrected prior to commencing work offshore. The rig medic should be trained to handle minor dental problems and to provide temporary fillings.

Major problems requiring evacuation are broken fillings and dental abscesses. In any dental program the emphasis must be on identifying and correcting problems before they become an emergency offshore. Employee orientation programs should feature the diet to follow to prevent dental caries and the diet profferred to the employee should be planned to discourage the consumption of rapidly absorbed carbohydrates.

## 5.3 ANALYSIS OF A RIG MEDIC'S LOG

To investigate the actual conditions encountered in practice, a rig medic's log for a six-month period November to April was obtained by the study group. The rig name has been altered to "A" to provide anonymity. Although the sample is small and the period covered applies only to winter conditions, the profile of the medic's sick parade provides a picture of the health state of the Canadian East Coast offshore drilling operations for the winter months. This picture, for the most part, confirms the U.K. experience on North Sea installations.

5.3.1. ILLNESSES vs ACCIDENTS (TABLE 1)

Table 1 shows that over 75% of the medic's time was devoted to dealing with illnesses. During the six-month period the first attendances for illnesses outnumbered those for accidents by a ratio of 4 to 1. However when the total attendances to the rig medic were categorized into illnesses or accidents the ratio was 3.5 to 1. If the first attendance is taken to indicate the number of incidents of either illness or accident it would appear that more visits to the medic were necessary for each accident than illness (averages of 1.6 and 1.4 visits per incident respectively). This difference may have arisen because for minor accidents (such as eye injuries) the patient was encouraged to return frequently, whilst for illness it was left to his discretion whether to return or not.

By regulation, self medication is not permitted on drilling units and for example, to obtain an aspirin for headache requires a

TABLE 1

VISITS TO RIG MEDIC SEPARATED INTO ACCIDENTS AND ILLNESSES FOR A SIX-MONTH PERIOD FOR RIG A (EXPRESSED AS THE NUMBER OF FIRST TIME ATTENDANCES AND TOTAL ATTENDANCES)

| | NOV. (27 days) | DEC. | JAN. | FEB. | MARCH (10 days) | APRIL | TOTAL |
|---|---|---|---|---|---|---|---|
| ACCIDENTS: Number of first time attendances | 34 - | 17 - | 28 - | 23 - | 4 - | 26 - | 132 - |
| Total number of attendances | - 42 | - 33 | - 49 | - 42 | - 6 | - 39 | - 211 (24.5) |
| ILLNESSES: Number of first time attendances | 87 - | 131 - | 104 - | 84 - | 30 - | 88 - | 524 - |
| Total number of attendances | - 105 | - 169 | - 128 | - 114 | - 49 | - 163 | - 728 (77.5) |
| TOTAL NUMBER ATTENDANCES | - 147 | - 202 | - 177 | - 156 | - 55 | - 202 | - 939 (100.0) |
| AVERAGE ATTENDANCES PER DAY | - 5.4 | - 6.5 | - 5.7 | - 5.6 | - 5.5 | - 6.7 | - 6.0 |

Number of visits per incident of:

Illness 1.4
Accident 1.6

figures in parentheses refer to percentages.

visit to the rig medic, although sometimes the rig medic dispenses enough of a medication to reduce the number of visits just for repeat medications. This regulation explains the large number of visits for what appear to be trivial conditions.

5.3.2 SEVERITY OF ILLNESSES AND ACCIDENTS (TABLE 2)

Table 2 shows that of the total of 656 cases seen by the medic, the doctor was called on 19 occasions and 21 cases were sent ashore. It also demonstrates that the company doctor had to be consulted more frequently (x4) for accidents than for illness that a much larger proportion (x16) of the victims of accidents had to be sent ashore for treatment as compared with workers presenting with illnesses.

5.3.3 MORBIDITY ON THE OFFSHORE (TABLE 3)

Table 3 relates the number of man hours worked per incident of illness or accident and compares the ratios with those reported in the North Sea sector. The figures from Rig A confirm that illnesses were four times as frequent as accidents. The North Sea figures do not show this trend, as accidents were reported slightly more frequently than illnesses. This could, in part, be due to different reporting practices.

For the six-month period Rig A compared unfavourably with the U.K. for both illnesses and accidents, the combined incidents being 3 times more frequent on the East Coast than in the North Sea workforce. There is no obvious explanation for this difference but the drilling period of Rig A was half that of the U.K. North Sea sector and covered only the winter months when it could be expected that incidents of accident or illness would be higher. It would be desirable to collect figures for comparable periods of time and to incorporate corrections for differences in reporting practices and in evacuation policies.

5.3.4 TYPE OF ILLNESS (TABLES 4 and 5)

Table 4 lists the number of incidents of illness on Rig A by diagnostic category. For Rig A, upper respiratory infections were by far the most numerous, (35.3%) followed by headaches (17.2%), "dry lips" or "dry skin" (9.9%) and dyspepsia (7.6%).

Table 5 shows that the percentages for these categories are similar to those in comparable offshore petroleum developments in the United Kingdom and in Sector X. Dental disorders appear to be low for Rig A. The figures for a land-based camp (NWT) are similar except for a lower percentage of "dermatological" which may be due to the difference in environmental conditions, i.e. lack of sea spray and sea winds.

Most of the employees complaining of dry lips or skin related it

TABLE 2

ACCIDENTS AND ILLNESSES WHERE ACTION WAS NEEDED
(DOCTOR CALLED OR PATIENT SENT ASHORE)

RIG A FOR A SIX-MONTH PERIOD

| | ACCIDENTS | ILLNESSES |
|---|---|---|
| DOCTOR CALLED | 10 (7.6) | 9 (1.7) |
| SENT ASHORE | 17 (12.9) | 4 (0.8) |
| TOTAL NUMBER | 132 (100) | 524 (100) |

FIGURES IN PARENTHESES REFER TO PERCENTAGE

The 4 illnesses sent ashore refer to:

Kidney stone )
Pyelonephritis ) Same patient

Anxiety-depressive reaction

Infection in right eye ?blocked duct.

TABLE 3

RATIO OF MANHOURS WORKED TO ONE ACCIDENT/ILLNESS FOR RIG A (157 days) AND A UK RIG (360 days)

| | | |
|---|---|---|
| Accidents | 1 per 1213* | 1 per 1674* |
| Illnesses | 1 per 306* | 1 per 1814* |
| Accidents and illnesses | 1 per 244* | 1 per 870* |

*Total number of "manhours" worked per accident/illness for 157 days (Rig a) and 360 days (UK).

Manhours worked = the number of employees per rig X length of shift (hours) X number of days; For Rig A (157) and for UK (360).

The UK Rig in the North Sea is situated east of the Shetland Isles so it is considered climactically comparable to Rig A.

The values for the UK rig are for the year 1976.
Reference: information from Prof. Norman's interim report).

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TABLE 4

ILLNESS ON RIG A DURING A SIX-MONTH PERIOD

| ILLNESS | Nov. | Dec. | Jan. | Feb. | March | April | Av. No. per mo. | LINE TOTAL & % of COLUMN TOTAL |
|---|---|---|---|---|---|---|---|---|
| Upper Respiratory Tract Infection | 25 | 49 | 34 | 25 | 12 | 40 | 36.5 | 185 (35.3) |
| Rashes | 1 | 0 | 3 | 3 | 1 | 5 | 2.6 | 13 (2.5) |
| Headaches | 18 | 27 | 12 | 18 | 4 | 11 | 17.8 | 90 (17.2) |
| Dyspepsia | 10 | 11 | 10 | 2 | 2 | 5 | 7.9 | 40 (7.6) |
| Infections (except URTI) | 2 | 3 | 4 | 3 | 0 | 5 | 3.4 | 17 (3.2) |
| Musculoskeletal | 3 | 5 | 4 | 3 | 1 | 3 | 3.8 | 19 (3.6) |
| Dry lips, dry skin | 16 | 10 | 10 | 8 | 0 | 8 | 10.3 | 52 (9.9) |
| Toothache | 3 | 0 | 2 | 0 | 4 | 1 | 2.0 | 10 (1.9) |
| Allergies (unspecified) | 0 | 3 | 1 | 0 | 0 | 1 | 1.0 | 5 (1.0) |
| Athletes Foot | 0 | 1 | 0 | 1 | 0 | 0 | 0.4 | 2 (0.4) |
| Diarrhoea | 0 | 1 | 2 | 0 | 0 | 0 | 0.6 | 3 (0.6) |
| Gonorrhoea | 0 | 0 | 0 | 0 | 0 | 1 | 0.2 | 1 (0.2) |
| Seasickness | 1 | 2 | 2 | 3 | 3 | 0 | 2.7 | 11 (2.1) |
| Sleep disturbances: | | | | | | | | |
| Noise | 1 | 6 | 0 | 4 | 0 | 1 | 2.4 | 12 (2.3) |
| Not noise | 1 | 1 | 6 | 1 | 0 | 0 | 1.8 | 9 (1.7) |
| Other | 6 | 12 | 14 | 13 | 3 | 7 | 10.9 | 55 (10.5) |
| COLUMN TOTAL | 87 | 131 | 104 | 84 | 30 | 88 | | 524 (100) |

TABLE 5

CAUSE OF ILLNESS CASES AS A PERCENTAGE OF TOTAL ILLNESS CASES FOR FOUR SOURCES OF DATA

| ILLNESS | RIG A | SECTOR X | NWT | U.K. | | | |
|---|---|---|---|---|---|---|---|
| | | | | 1976 | 1977 | 1978 | 1979 |
| Respiratory & headaches | 52.5 | 41.2 | 49.6 | 62.2 | 54.6 | 48.7 | 43.6 |
| Gastro-intestinal | 8.2 | 18.4 | 16.9 | 13.4 | 12.8 | 15.0 | 15.2 |
| Musculo-skeletal | 3.6 | 7.2 | 8.3 | 5.9 | 13.3 | 5.9 | 9.5 |
| Dermatological (rashes, dry skin and lips) | 12.4 | 11.8 | 2.5 | 8.3 | 10.1 | 11.0 | 15.5 |
| Dental | 1.9 | 7.2 | 5.4 | 2.9 | 1.4 | 9.3 | 5.5 |
| Other | 21.3 | 15.1 | 17.4 | 7.3 | 7.7 | 9.9 | 10.6 |

Rig A - 6 month collection period. Information obtained from rig medic's log book.

U.K. - Illness figures from one isolated platform in the North Sea, U.K. for 4 years (from Prof. Norman's interim report).

Sector X - Illness figures for a 6-month period from a confidential source of data referring to offshore circumpolar petroleum productions.

NWT - 12 months of illnesses' figures from a land-based camp servicing both drilling and new project construction crews. (CONFIDENTIAL SOURCE)

to weather conditions out of doors and not to inadequate humidification of the air conditioning system. For Rig A the cause of headaches (Table 4) was not stated, so it is not possible to determine how many were due to tension or migraine or represented the early phase of an upper respiratory tract infection or were due to hypothermia. Similarly a breakdown of dyspepsia by causes is not available.

Musculo-skeletal complaints made up only a small portion (3.6%) of Rig A's illnesses compared to other sectors (5.9-13.3%) (Table 5). This may be related to differences in the type of the workforce, as the United Kingdom figures are from a production platform which typically includes older workers who are more prone to develop lower back pain.

On Rig A the incidence of food poisoning (nausea, vomiting and diarrhoea) and dental problems was low and there were no identifiable health problems directly related to exposure to drill muds or hydrocarbons or their by-products.

## 5.4 SUMMARY OF ANALYSIS

Data recorded by Rig A medic while the rig was conducting drilling operations on the Canadian East Coast shows:

i. Illnesses outnumber accidents by 4 to 1.

ii. Illnesses were less severe than accidents and the vast majority required neither evacuation nor consultation with the onshore physician.

iii. On Rig A, for unexplainable reasons, the employees were more prone to develop illness and to suffer accidents than in the UK North Sea sector.

iv. As in similar operations in the North Sea and on land (NWT) the majority of illnesses were mild upper respiratory tract infections, headaches, and dry lips due to weather conditions. Conditions said to be frequent in other operations such as scabies, food poisoning, low back pain and dental problems were infrequent. There were no identifiable industrial diseases on Rig A.

## 5.5 CONCLUSION

The limited sample studied of the health of workers on the Canadian East Coast shows a pattern similar to that in the United Kingdom North Sea sector and in a land-based operation in the North West Territories, with illnesses, mostly mild, greatly outnumbering accidents. Occupational or industrial illness,

related to exposure to hydrocarbons or its by-products do not represent hazards at present but such problems can be anticipated when the production phase is reached. Of these, exposure to hydrogen sulphide gas will be the most immediate danger.

A more detailed profile of the health of offshore workers on the Canadian East Coast petroleum operations is required. Information should be obtained on all aspects of the health of each employee before, during and after specified periods of work. This information should be recorded on standardized forms and designed to meet the needs of four independent but interrelated groups interested in the health of offshore workers:

i) Industry who wishes to know how healthy its operations may be.

ii) The employee who wants to know how healthy it is for him to work offshore.

iii) The regulatory body whose aim it is to see that the health of Canadians is as well protected offshore as onshore, and

iv) Academic medicine which has the expertise for initiating epidemiologic studies in order to determine patterns of sickness and changes in the health status of the offshore employees.

As in other systematic studies of health and sickness the record forms should be scrutinized regularly so as to permit detection of deficiencies in data collection or faults in the design of the form. The analysis of the data collected should conform to accepted principles. In those releases of information and in the conduct of the studies, company and employee confidentiality would be strictly respected.

The study should be designed so that the data recorded will permit meaningful comparisons with foreign petroleum offshore operations and with onshore Canadian industries.

## REFERENCES

1. Bustin, H.E.; Environmental Health Requirements on Offshore Oil and Gas Exploration and Production Installations, Aberdeen, p. 102.

2. Cox, R.A.F.; Offshore Medicine, Medical Care of Employees in the Offshore Oil Industry, Springer-Verlag, New York, 1982, p. 85.

3. Johnston, J.E. et al; New England Journal of Medicine, 309: pp. 523-526, 1983.

Chapter 6

# ACCIDENT DATA COLLECTION

## PART I - LIMITATIONS OF ACCIDENT DATA COLLECTION IN THE PETROLEUM INDUSTRY

## 6.1 INTRODUCTION

The analysis of a rig medic's log reported previously showed that although accidents were less frequent than illnesses, they occasioned more visits to the medic, required more consultations and were sent to shore more frequently. This part of the study discusses the general problems of obtaining data on accidents and the limitations of using such data for comparative purposes. Factors which have been implicated in accidents are reviewed. An analysis of offshore accidents in Newfoundland waters over a three year period is presented and comparisons are made with reported figures from other offshore and onshore operations.

## 6.2 COLLECTING DATA ON ACCIDENTS

The collection of data on accidents is essential for considerations of matters of health and safety but presents a number of problems in classification, reporting and interpretations.

### 6.2.1 CLASSIFICATION OF ACCIDENTS

Accidents can be classified as fatal and non-fatal. This obvious classification can be extended to describing non-fatal accidents as minor or serious. Table 1 illustrates the marked differences from country to country in terminology and in criteria used for classification of minor and serious accidents.

The criteria are often so unprecise that comparisons of petroleum extraction related accidents between countries are difficult or even impossible. Even within a country usage of terms such as minor or serious may lead to disagreements. In spite of such difficulties in classification, accident data must be sought to provide a basis for determining causative or contributory factors and for seeking preventive measures.

TABLE 1

Non-fatal Accidents

| Country | Minor Accident | Serious Accident |
|---|---|---|
| United Kingdom | Over 3 days and not called serious | Serious as defined by degree of injury, not time |
| Netherlands | Over 3 days and under 8 weeks | Over 8 weeks as judged by accident investigating doctor |
| Federal Republic of Germany | Class 1, 4 days to 4 weeks<br>Class 2, 4 to 8 weeks | Over 8 weeks by medical records |
| Ireland | No definition | No definition |
| Sweden | Over 1 day | No definition |
| Norway | First aid given | No definition |
| Italy | With medical certificate For 3 to 30 days | With medical certificate For more than 30 days |
| Indonesia | Less than 3 weeks | More than 3 weeks |

Source: International Labour Office - Geneva 1978. "Safety Problems in the Offshore Petroleum Industry"

## 6.2.2 PURPOSE OF STATISTICS

By amassing reports of individual accidents, data is accumulated to yield a picture not only of the numbers and types of accidents which occurred, but of relationships between the items recorded. Information derived from statistical analysis of accumulated experience is necessary to establish guidelines in planning health and safety programs and to provide bases for measuring the effects of these programs.

A simple statement of the number of accidents that occurred is misleading. The convention is to require that the number of accidents be expressed in relation to a baseline value such as the number in the population at risk. The incidence or frequency rate is expressed as the number of accidents per man hours worked, usually expressed in terms of two thousand man hours, one million

man hours, or ten thousand man years(1,2). This method allows comparison of the frequency of accidents in different work locations with differing sizes of work force.

In addition to measures of incidence, data is required that can be used to analyze the circumstances of accidents, grade their severity, and establish correlations with factors such as the part of the body injured, type, nature, and job classification.

### 6.2.3 INFORMATION REQUIRED ON ACCIDENT NOTIFICATION FORMS FOR STATISTICAL PURPOSES

The basic tool in studying accidents is a single report form which can be used by different observers to record the following basic data for each accident:

i. Cause

ii. Part of body injured

iii. Type of accident, e.g. struck by, fell, etc.

iv. Nature of accident, e.g. contusion, fracture, etc.

v. Location on unit

vi. Occupation

vii. Time relationships, i.e. the point of time in the current drilling season, hitch and shift

viii. Contributory factors.

In devising such a form, care must be taken to avoid using terms which involve ambiguity both to the person completing the items and to the person who abstracts the data for analysis.

### 6.2.4 FACTORS AFFECTING REPORTING AND CATEGORIZING ACCIDENTS

In addition to ambiguities in terminology some practices are known to affect the provision of information on accidents.

a. Safety Bonus System

The safety bonus system has been introduced in industry as a means of motivating workers to avoid accidents. If a drill unit or supply/support vessel does not report any accidents for a specified period of time each employee receives a financial or other reward. Thus there is an incentive not to report accidents for fear of losing the reward. This could encourage practices such as returning individuals to "light"

duties instead of regular duties, and retaining a person on the drill unit who is not able to work but has only a day or two left in his hitch.

b. Lost Time

In some studies of industrial accidents, the amount of time lost by the victim can be used as a measure of the consequences of the accident. "Lost time" may not be valid criteria of the severity of an offshore accident. Onshore an employee can be treated for a trivial accident and continue work without loss of time. For the same injury offshore he could lose time if he had to be evacuated to receive the same medical attention. This criterion can only be applied with caution to comparisons between offshore units.

c. Medical Evacuation

It might be expected that the decision to evacuate a patient would indicate that the condition was serious. Medical evacuation, except when urgently requested, is not a measure of the severity of an accident or illness. For example, dental problems usually require evacuations since the rig medic can only provide temporary fillings or extraction of teeth. Again this criterion can only be applied in comparisons between offshore units.

## 6.3 THE ACCIDENT SCENE ON OFFSHORE OIL OPERATIONS

Given the above cautions about the nature of the data, information on accidents derived from various parts of the world shows a number of interesting features.

### 6.3.1 INCIDENCE

While comparisons are difficult, ratios give a picture of the magnitude of the different types of near misses and accidents. For example, over the five year period from 1975-1979 for the U.K. North Sea sector Simpson(1) reported that the incidence of all accidents was 375.67 per 10,000 man years. Using this same denominator the figure for minor injuries was 351.6, dangerous occurrences 31.13, serious injuries 19.84 and fatalities 4.4. These and figures from other studies demonstrate that the majority (over 85%) of all accidents are neither serious nor fatal.

### 6.3.2 CAUSE

The attribution of the cause of an accident is largely a matter of opinion. Requiring that accident forms for compulsory notification purposes record the cause is unrealistic since management will be reluctant to admit any failure on its part, for

fear of being held liable, nor will an employee admit that his injury was due to his, or another°s negligence. Where the cause of the accident is supplied by the work supervisor or other observers it is not possible to exclude bias. On the Canadian East Coast Petroleum Operations inquiry into a serious accident is customary and it is usually conducted by NLPD and/or COGLA. The following possibilities should be considered but usually the cause is multi-factorial(3).

a) Equipment

Failure

Defective construction

Defective maintenance

Operation of heavy equipment, hampering body movement

Deficiency or failure of built-in safety features.

b) Facilities

Deficiencies in safety features, i.e. lack of railings on gangways, etc., poor illumination, etc.

c) Personal factors in accidents

In addition to deficiencies in equipment and facilities, some characteristics of the typical victim of an accident have been described.

i) Experience

The incidence of accidents has been reported to be highest in employees who are new to the job(2). In some offshore oil operations the turnover of the workforce is 100%(4). This implies upward mobility involving frequent job changes with an employee spending one year on the drill floor, then one year as a derrickman before he becomes a driller. Each change of job entails a new learning experience and a new period of vulnerability to accidents(5).

Working up the organizational hierarchy is a traditional aspect of the oil industry. There are indications that if an employee works offshore for greater than two years then he has a long range plan to make a career with the industry. Therefore he will be periodically exposed to greater than average risk of accident as he learns each new operational level job.

Furthermore a skilled employee may become rusty if there is no opportunity to exercise a skill constantly. During the drilling phase crane operations are less used than during the exploratory phase and accidents may arise when the crane operator resumes operations with reduced skill. If a crane is not in constant use, accidents may occur if an inexperienced person is assigned to operate it when the need arises(2).

ii) Level of Knowledge

Insufficient knowledge of a required procedure, unfamiliarity and clumsiness were cited by Boucheny(5) as causes in 90% of accidents. This should be expected because in the oil industry most jobs are learned through on-the-job training.

iii) Attention

Negligence arising from inattention due to boredom or distractibility may be responsible for accidents.

iv) Protective Equipment

Failure to wear goggles, etc.

v) Team Work

The coordinated efforts of a team are required in most procedures on the drill units. The team may be composed of individuals who differ greatly in their levels of skill and experience and accidents may arise when coordination is lost.

vi) Sense of Responsibility

The conventional approach to safety is to regulate conditions of work to reduce or avoid hazards. This approach depends on the cooperation of individuals. An employee must in the final analysis be motivated to take responsibility for his own safety.

vii) Response to a Crisis Situation

The natural reflex reaction to a novel situation requiring quick decisions may be to use a previously learned reaction. This can be dangerous when it occurs in inappropriate situations e.g. automatically retrieving an electric power tool which has fallen into water.

viii) Physical Health Status

It is recognized that many mild physical conditions may lead to vertigo, loss of dexterity, lack of agility or slowed reactions which could contribute to accidents. Impairment of one or more of the five senses, impaired cardio-respiratory function, migraine attacks, bodily cramps, sudden pain and many other disorders have been implicated.

ix) Psychological Aspects

The dispirited worker suffering from depression, lack of concentration because of sleep disturbance or experiences of panic because of anxiety are among many examples of psychological disturbances which may give rise to accidents. (A worker who is present at an accident to a colleague may inaccurately ascribe blame to himself on the basis of guilt feelings.)

The above hypothetical potential causes for accidents can be listed, but, in practice, it is difficult to obtain firm evidence to indicate which one or group of causes operated. By their nature accidents are unexpected events and determining the cause in retrospect produces inaccuracy.

### 6.3.3 ACCIDENTS IN RELATION TO TYPE OF FACILITY

Various types of drill units present different potential hazards. Fixed platforms involve a considerable outlay of heavy construction and at this phase the accident rate is high. Semi-submersibles are less safe than fixed platforms and are at risk for both structural cracks in the legs and the danger of collapse. An analysis by Friis(3) shows that jack-ups are by far the most vulnerable of all types of drill units to damage and destruction, that drill ships and barges are not suitable for stormy seas, and that all units are more vulnerable to mishap when being moved. The incidence of accidents is said to be lower on standby/supply vessels than on drill units and more likely to be related to wave action(4).

### 6.3.4 ACCIDENTS AND PHASE OF DEVELOPMENT

The most hazardous phase of drilling operations appears to be the exploratory phase(6). The accident rate decreases with field development and construction and a further decrease occurs at the production phase. However when maintenance operations are increased the incidence of accidents rises.

## 6.3.5 ACCIDENTS AND SPECIFIC OPERATIONS

Since the U.K. figures quoted previously indicate differences in frequency for fatal and non-fatal accidents these two categories require separate discussion.

### a. Fatal Accidents

Of 82 fatal accidents which occurred in the Norwegian sector of the North Sea in thirteen years, 42% were due to helicopter crashes, 21% occurred on the rigs, 11% occurred during emergency evacuation, 10% were due to diving and 4% to drilling(4). Explosions and fires, although rare, usually result in a large number of fatalities.

### b. Non-fatal accidents

Evidence to the Burgoyne Committee(7) indicated that the most hazardous operations are those involved in drilling, especially pipe handling, which is responsible for many injuries to fingers and hands. The drill floor which is frequently slippery due to drill mud is a common place for accidents.

Operations connected with the derrick and crane are also dangerous, especially when loading and unloading in heavy seas or poor visibility when the coordinated efforts of the operator, ship's captain and flag man are required. Catering is responsible for a number of accidents particularly lacerations and amputations of fingers. Handling dangerous products such as caustic soda and other corrosive compounds can also cause burns both to the skin and the eye.

## 6.3.6 TIME RELATIONSHIPS AND ACCIDENTS

### a. Hitches and Shifts

An International Labour Office study(8) claims that the incidence of accidents is highest in the first four hours of a shift, another that the incidence is highest at both the beginning and the end of a shift or tour of duty(6). Furthermore the claim has been advanced that the incidence of accidents is higher in a tour of duty of two weeks on and two weeks off (14/14) compared to a hitch of one week on and one week off (7/7).

For drill units throughout the world hitch periods (in days) vary from the 7/7 (Gulf of Mexico and Middle East) to 28/28.

In the North Sea it is usually 14/14. In the Canadian and Alaskan offshore it is 21/21 or 28/28. For standby/supply vessels a more flexible system is in operation, usually 28/28.

Information was requested from drilling companies operating on the Canadian East Coast. Six replied, the data they supplied can be summarized:

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Length of shift: 12 hours in all companies

Schedule of shifts: (varies among companies) alternating weeks of days and nights, 50% days and 50% nights, 14 days and 7 nights or 14 nights and 7 days (alternating depending on worker's schedule), or in the case of 14-day hitch, 1 week of days followed by 1 week of nights.

Tour of duty (days): 21/21 in five companies, 14/14 in one company

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At the change of shifts a split shift system is operated with the oncoming shift working 2400-1200 hours and then changing as shown:

| Crew A | Crew B |
|---|---|
| 2400-1200 | 1200-1800 |
| 1800-2400 | 2400-1200 |
| 1200-2400 | 2400-1200 |

Many of the crew on drill units work rotating day and night shifts while others, including management and administrative support personnel, work day shifts but are on call during the night shift.

b. Circadian (biological) Rhythms

Circadian rhythms are those biological rhythms which have the "24-hour day" as their periodicity, i.e. they complete a full cycle in the 24 hours. All humans have innate circadian rhythms which are entrained by "synchronizers", e.g. light/dark and sleep/wake cycles. These circadian rhythms are

present in many physiological variables, e.g. changes in concentration of various constituents in the urine and serum, body temperature and pulse rate.

Based on measurement of these circadian rhythms considerable scientific literature on the biological aspects of shift work has been published in recent years. Bodily processes are attuned to the twenty-four hour clock of waking and sleeping. With a change of shift from a day to a night shift the biological processes are modified in response to a different sleep/wake cycle.

The findings from investigations of the adaptation of shift workers to changes in sleep and work hours can be summarized as follows:-

i) The length of the shift should be related to the type of work and particularly to the energy expenditure required. If the work is light, the length of the shift may (with caution) be extended to 12 hours, but for normal work it should not exceed 8 hours. For work involving particularly heavy physical energy expenditure or a considerable mental load the shift should be reduced to 6 hours(9).

ii) It has been suggested that a long period on night shift or even permanent night shift permits circadian rhythms to adapt. On this basis a long period of night work is preferable to a short period(10).

iii) The rate and extent of adjustment of circadian rhythms decreases with age. Depending upon the individual, cycles take one or two weeks to adapt to an inversion of the sleep-wake cycle. While the various circadian functions of the body are inter-related they act independently in their ability to adjust to changes. Incomplete adjustment and desynchronization of cycles are responsible for many of the maladjustments to shift work such as dyspepsia, sleep disturbances and neuroticism(11).

iv) A 12-hour alteration in sleeptime puts the circadian system into an ambiguous situation which results in "choice" in which the system can become re-entrained either through advances or through delays(12).

While shift work per se is not harmful to health, Baker(11) found that some 20% of the workforce were unable to tolerate rotating shifts. Such individuals tend to be self-screening in that they soon leave the offshore environment for other employment.

### 6.3.7 ENVIRONMENTAL FACTORS CONTRIBUTING TO ACCIDENTS

a. Weather
Because of bad weather in the North Sea it has been suggested that workers are more alert to dangers and that this increased alertness might exert a beneficial effect on the incidence of accidents. However bad weather may interfere with offshore operations. Cranes loading and unloading cargoes in sudden gusts of wind or in poor visibility may contribute to serious accidents. Bad weather is also important in helicopter transportation. In the East Coast of Canada the climate is even more significant and operators have to cope not only with fog and wind but also with ice bergs.

b. Work Milieu
As discussed previously noise/vibration, hypothermia, hyperthermia and poor illumination can contribute to accidents.

### 6.3.8 ACCIDENTS IN THE U.K. NORTH SEA SECTOR

Hendry(13) pointed out that in the North Sea the common accidents on fixed installations and semi-submersibles occurred in a relatively young age group and that the predominating serious accidents were falls from heights causing head and serious limb accidents in drillers. On the other hand accidents on standby/supply boats occurred in an older age group and commonly involved severe crush injury caused by moving cargo.

Since this is a serious injury and one which it is difficult to manage, consideration needs to be given to training of standby/supply vessel crews to cope with such an injury, to determine the equipment which should be carried on the vessel and how access to the vessel can be gained by medical personnel from onshore or from the drill unit. The basis for the decision to remove the casualty by helicopter ashore or to move him aboard the installation should be worked out carefully in advance (Refer to Chapter 10, "Standby Vessels").

### 6.4 **SUMMARY - PART I**

1. There is no international agreement for grading accidents by degrees of severity and criteria differ from one jurisdiction to another. Thus comparison between jurisdictions are possible only to a limited extent.

2. Common standards are followed in categorizing accidents by part of the body injured, type and nature of the injury.

3. The safety bonus system probably has the effect of leading to the underreporting of accidents.

4. Estimating the severity of an offshore accident is difficult. Lost-time may not be a valid criterion since on shore an employee can be treated for a trivial accident and continue working whilst offshore he would have to be evacuated to receive the same attention. Neither is medical evacuation a valuable criterion except when urgently requested, since evacuation is required for any health problem that cannot be treated on the rig or standby supply vessel.

5. The majority of accidents are not serious. Dangerous occurrences probably far outnumber accidents but are probably underreported.

6. The cause of most accidents is probably multi-factorial including equipment and personal failure, health state and other contributory factors. It is usually difficult to assign responsibility because management will not admit blame for fear of liability, and neither will the employee for fear of disciplinary action because of negligence.

7. The accident rate rises when a drill unit is in tow. Some types of drilling units are more hazardous than others. Generally, the amount of construction or maintenance going on on a drill unit influence the accident rate.

8. The accident rate is higher during the exploratory phase than during the production phase but rises once again with maintenance.

9. Certain operations are hazardous such as diving, drilling, pipe handling and catering.

10. The time relationships of accidents to shift and hitch has been studied by others but the evidence is inconclusive.

11. Accident statistics are collected to ascertain the incidence of accidents, to grade them by severity and to further analyze them by part of body injured, type, nature and occupation, and the time they occur in relation to shift and hitch. The purpose of this collection is to develop safety education and accident prevention programs based on statistical analysis.

12. Data on causation is difficult to collect but is required if the incidence is to be reduced. Causation may be categorized as:- equipment failure, personal failure, psychological features and contributory factors.

Chapter 6

PART II

## AN ANALYSIS OF ACCIDENTS ON DRILLING UNITS AND STANDBY SUPPORT VESSELS FOR THE NEWFOUNDLAND AND LABRADOR OFFSHORE 1980-82

### 6.5 OBJECTIVE

The objective of this study was to analyze and compare the accident rates of drilling units and standby/supply vessels operating in the Newfoundland and Labrador offshore and to compare the rates with similar operations elsewhere in the World.

### 6.6 METHODOLOGY

#### 6.6.1 SOURCE OF DATA

Accident reports were obtained from COGLA, NLPD and WCB (Newfoundland), and from several petroleum companies. The rig medic's log for a six-month period previously referred to was also used. Accident statistics from other parts of the World were obtained including the Norwegian and U.K. sectors of the North Sea. Data obtained from the Scotian Shelf was found to be inadequate for comparison with the Newfoundland/Labrador scene.

#### 6.6.2 SELECTION OF DATA

Data from drill units and standby/supply vessels was then compressed. In some tables data from three specific rig (A, B and C), of one operator are compared. Rig A refers to the rig from which the rig medic's log was obtained.

Initially separate analyses were carried for drill units and for standby/supply vessels.

The accident data collected from the Canadian East Coast petroleum operations and analyzed by the study team is "soft" data as those accidents reported to COGLA, NLPD and WCB can not always be cross referenced and verified. For example, several accidents reported as involving lost time by one source were not identified as lost time accidents by another source. These discrepancies allow comparisons of only limited validity and reliability. In spite of the limitations, the findings on the East Coast offshore were not dissimilar to those observed in other parts of the World and they present a picture of conditions as they now exist on the East Coast offshore.

6.6.3 CLASSIFICATION OF ACCIDENTS

i) Fatal
i.e. resulting in death.

ii) Non-fatal
"minor" - no evacuation, treated on the rig with no lost time
"major" - involving lost time.

Although it is appreciated that °lost time° and °evacuation° are both unsatisfactory criteria of severity the combination is used in this study and only in comparing offshore units.

## 6.7 RESULTS

### 6.7.1 FREQUENCY OF FATAL ACCIDENTS

Exclusive of the Ocean Ranger disaster there was one fatal accident for the years 1980-82, when a seaman on a standby/supply vessel was lost when he was washed overboard by high waves. He was not attached to a lifeline nor wearing a life jacket.

### 6.7.2 FREQUENCY OF NON-FATAL "MAJOR" AND "MINOR" ACCIDENTS ON ALL DRILL UNITS

From Table 2 it is apparent that more accidents occurred on Rig A and that the percentage of "major" accidents on Rig A was more than double that on Rig B. There is no obvious explanation for the differences between these two rigs. As no information on "minor" accidents was received for standby/supply vessels, a comparision between accidents on drill units and these vessels was not undertaken.

### 6.7.3 SUBGROUPING OF "MAJOR" ACCIDENTS ON DRILL UNITS AND STANDBY/SUPPLY VESSELS

The amount of lost time and "major" accidents were classified into those with lost time up to 4 weeks and those over 4 weeks. Those over 4 weeks comprised almost 50% (Table 3) of "major" accidents for both drill units and standby/supply vessels. Furthermore the average time lost was almost the same for both (9.9 weeks and 10.2 weeks respectively). Thus for time lost there was little difference between drill units and standby/supply vessels.

### 6.7.4 "MAJOR" ACCIDENTS RELATED TO DRILLING

Table 4 shows the number of "major" accidents as reported to the Newfoundland and Labrador Petroleum Directorate for Rigs B and C, from the same operator for three years. Both these rigs commenced drilling in Newfoundland waters at roughly the same time.

On Rig C there were a number of "major" accidents during the first few months, probably related to the crew°s initial unfamiliarity

## TABLE 2

### ACCIDENTS ("MAJOR" AND "MINOR") PER MONTH ON TWO RIGS AND AVERAGED FOR 6 MONTHS (RIG A) AND 2 2/3 YEARS (RIG B)

TOTAL NUMBER OF ACCIDENTS

| MONTH | RIG A | | RIG B | | |
|---|---|---|---|---|---|
| | YEAR 1 | YEAR 2 | YEAR 1 | YEAR 2 | YEAR 3 |
| JANUARY | | 28 | | 1 | 10 |
| FEBRUARY | | 23 | | 2 | 4 |
| MARCH | | 4(10 days only) | | 7 | 9 |
| APRIL | | 26 | | 1 | 8 |
| MAY | | | 11 | 5 | 7 |
| JUNE | | | 16 | 7 | 10 |
| JULY | | | 9 | 7 | 7 |
| AUGUST | | | 0 | 7 | 7 |
| SEPTEMBER | | | 6 | 10 | 4 |
| OCTOBER | | | 0 | 13 | 7 |
| NOVEMBER | 34 | | 0 | 9 | 9 |
| DECEMBER | 17 | | 2 | 4 | 3 |

| | RIG A | RIG B |
|---|---|---|
| Accidents/Month | 26.1 | 7.9 |
| "Major"Accidents/Month | 2.0 | 0.2 |
| "Major"Accidents/Month as a percentage of all accidents | 7.6 % | 3.0 % |

Rig A - Information obtained from Rig Medic's log for 6 month period (winter months). (This period being the commencement of operation in Nfld. waters for this rig.)

Rig B - Information obtained from monthly company accident reports for 2 2/3 years.

NOTES:

Rig A - In port for November; drilling from mid December; suspension of drilling in March due to adverse weather conditions; resumed drilling in April.

Rig B - Year 1 - drilling all year
Year 2 - not drilling May and most of June
Year 3 - not drilling mid February to mid April

TABLE 3

"MAJOR" ACCIDENTS ON DRILL UNITS AND STANDBY/SUPPLY VESSELS 1980 - 82 EXPRESSED AS LOST TIME a)LESS THAN OR EOUAL TO 4 WEEKS b)OVER 4 WEEKS

| LOST TIME (WEEKS) | DRILL UNITS | | STANDBY/SUPPLY VESSELS | |
|---|---|---|---|---|
| | Number | Percentage of total | Number | Percentage of total |
| ≤4.0 | 72 | 39.8 | 59 | 45.7 |
| ≥4.0 | 82 | 45.3 | 61 | 47.3 |
| NOT SPECIFIED | 27 | 14.9 | 9 | 7.0 |
| TOTAL | 181 | 100.0 | 129 | 100.0 |

AVERAGE Drill Units - 9.9 weeks
Standby/Supply vessels - 10.2 weeks

DATA OBTAINED FROM WCB (NFLD.) RECORDS

TABLE 4

"MAJOR" ACCIDENTS FOR TWO RIGS OVER A THREE-YEAR PERIOD
1980-82

| MONTH | RIG B | | | RIG C | | |
|---|---|---|---|---|---|---|
| | 1980 | 1981 | 1982 | 1980 | 1981 | 1982 |
| JANUARY | 1 | 0 | 0 | 0 | 0 | 0 |
| FEBRUARY | 0 | 2 | 0 | 2 | 0 | 0 |
| MARCH | 0 | 0 | 0 | 2 | 0 | 0 |
| APRIL | 3 | Missing | 0 | 1 | 0 | 0 |
| MAY | 1 | 0 | 0 | 3 | 0 | 0 |
| JUNE | 0 | 0 | 1 | 1 | 0 | 0 |
| JULY | 1 | 0 | 0 | 0 | 0 | 2 |
| AUGUST | 2 | 1 | 0 | 0 | 0 | 2 |
| SEPTEMBER | 1 | 0 | 0 | 0 | 0 | 2 |
| OCTOBER | 0 | 0 | 0 | 0 | 0 | 1 |
| NOVEMBER | 0 | 1 | 0 | 0 | 0 | 0 |
| DECEMBER | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTAL | 9 | 4 | 1 | 9 | 0 | 8 |

with the rig, duties and with fellow workers. Subsequently there was a remarkable drop in the accident rate to zero for two years but then for uncertain reasons "major" accidents began to occur again. However, there were indications that this particular rig may have lost its safety bonus when the two accidents occurred in July 1982 and there would be no incentive to under report accidents until the next safety bonus period commenced.

Rig B, on the other hand, showed a scattering of accidents throughout the three years without any noticeable peaks. While it is interesting to note the differences in accidents between the two rigs it is unwise to draw firm conclusions from variations in their frequency, as so many factors influence the reporting of accidents.

### .7.5 PART OF BODY INJURED ON ALL DRILL UNITS AND STANDBY/SUPPLY VESSELS

Table 5 shows that for drill units and standby/supply vessels in the waters off Newfoundland and Labrador, the hand/wrist was the most frequently injured part of the body in both "major" and "minor" accidents. The eye was second in frequency for "minor" accidents on rigs. On standby/supply vessels, the hand/wrist is the most commonly injured part of the body. The hand/wrist, foot/ankle and back are equally vulnerable for "major" accidents.

Table 6 shows comparisons for drilling operations with data from other sources. With one exception all sources agree in listing the hand/wrist as the most frequently injured part of the body for all accidents. It can be seen that the data for Newfoundland waters agrees with that of other parts of the world including land-based accidents in Alberta.

Compared with WCB data for all offshore operations(Table 6) Rig B had a higher percentage for all accidents to the hand/wrist and eyes. This probably arises because the monthly accident summary used for Rig B reports all accidents including many minor ones which are not reported in the WCB listings. From this study it appears that the hand/wrist is the most frequently injured part of the body regardless of the severity of the injury. The relevance of injury to other parts of the body is less striking.

Of practical importance, it emerges that accidents involving injuries to the eye do not usually result in lost time while those involving back injury are more liable to require evacuation and loss of working time.

### .7.6 TYPE OF ACCIDENT FOR DRILL UNITS AND STANDBY/SUPPLY VESSELS

In a significant proportion of the data the type of accident was not specified for either drill units or standby/supply vessels. Table 5 shows that "being struck" was by far the most common type

TABLE 5

ACCIDENTS ("MAJOR" AND "MINOR") IN RELATION TO PART OF BODY, TYPE AND NATURE OF ACCIDENT FOR DRILL UNITS AND STANDBY/SUPPLY VESSELS, EXPRESSED AS PERCENTAGES 1980-82

| | "MINOR" | | "MAJOR" | |
|---|---|---|---|---|
| PART OF BODY | DRILL UNITS | STANDBY/SUPPLY VESSELS | DRILL UNITS | STANDBY/SUPPLY VESSELS |
| Head/Neck | 11 | 4 | 4 | 3 |
| Eye | 17 | 4 | 4 | 2 |
| Hand/Wrist | 30 | 31 | 28 | 20 |
| Arm | 7 | 11 | 9 | 10 |
| Foot/ankle | 7 | 13 | 14 | 19 |
| Leg | 11 | 13 | 7 | 12 |
| Back | 9 | 13 | 18 | 17 |
| Multiple | 3 | 4 | 9 | 9 |
| Other | 5 | 7 | 7 | 8 |
| TOTAL | 100 | 100 | 100 | 100 |
| TYPE OF ACCIDENT | | | | |
| Struck | 45 | 50 | 38 | 36 |
| Caught | 12 | 6 | 8 | 3 |
| Slipped/ tripped | 8 | 18 | 10 | 24 |
| Overexertion | 6 | 12 | 14 | 15 |
| Fell | 3 | 4 | 7 | 7 |
| Other | 5 | 3 | 6 | 1 |
| Not specified | 21 | 7 | 17 | 14 |
| TOTAL | 100 | 100 | 100 | 100 |
| NATURE OF ACCIDENT | | | | |
| Contusion | 39 | 47 | 36 | 38 |
| Laceration | 14 | 17 | 5 | 9 |
| Fracture | 2 | 0 | 9 | 9 |
| Amputation | 0 | 0 | 2 | 1 |
| Sprain | 9 | 19 | 22 | 26 |
| Foreign Body | 10 | 3 | 1 | 2 |
| Burn | 2 | 1 | 4 | 1 |
| Other | 3 | 4 | 3 | 0 |
| Not specified | 21 | 9 | 18 | 14 |
| TOTAL | 100 | 100 | 100 | 100 |

TABLE 6

PART OF BODY, TYPE AND NATURE OF ACCIDENT FROM VARIOUS SOURCES OF DATA FOR PETROLEUM DRILLING INDUSTRY ACCIDENTS ON DRILL UNITS AND STANDBY/SUPPLY VESSELS. FIGURES EXPRESSED AS PERCENTAGES OF TOTAL ACCIDENTS

| | WCB (NFLD.) (3 years) | | RIG B (2 2/3 years) | OCS* (4 years) | USCG** (3 years) | SOURCE X+ (1 year) | WCB (ALBERTA)# (Land-based) (5 years) |
|---|---|---|---|---|---|---|---|
| | All Acc's | Lost time acc's only | All accidents | Lost time accidents only | Not specified | Not specified | Lost time accidents only |
| **PART OF BODY** | | | | | | | |
| Head/neck | 6 | 4 | 6 | 7 | 9 | 7 | - |
| Eye | 7 | 3 | 15 | 7 | 10 | 9 | 5 |
| Hand/wrist | 27 | 25 | 44 | 19 | 24 | 25 | 22 |
| Arm | 9 | 10 | 9 | 8 | 7 | 7 | 5 |
| Foot/ankle | 13 | 16 | 9 | 9 | 8 | 13 | 12 |
| Leg | 10 | 9 | 9 | 23 | 16 | 15 | 11 |
| Back | 14 | 17 | 5 | 18 | 22 (trunk) | 15 | 17 |
| Multiple | 6 | 9 | 1 | - | - | - | 6 |
| Other | 8 | 7 | 3 | 10 | 4 | 10 | 23 |
| TOTAL | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **TYPE OF ACCIDENT** | | | | | | | |
| Struck | 42 | 37 | 36 | 41 | 35 | Information | 27 |
| Caught | 8 | 6 | 18 | 16 | 20 | Not | 17 |
| Slipped/tripped/fell | 19 | 23 | 10 | 27 | 26 | Available | 16 |
| Overexertion | 12 | 15 | 2 | 10 | 8 | | 14 |
| Other | 3 | 4 | 15 | 6 | 11 | | 26 |
| Not specified | 16 | 15 | 19 | - | - | | - |
| TOTAL | 100 | 100 | 100 | 100 | 100 | | 100 |
| **NATURE OF ACCIDENT** | | | | | | | |
| Contusion | 39 | 37 | 26 | 44 | Information | 29 | 26 |
| Laceration | 11 | 7 | 32 | 12 | Not | 15 | 12 |
| Fracture | 5 | 9 | 4 | 9 | Available | 10 | 16 |
| Amputation | 1 | 1 | 1 | 2 | | 1 | - |
| Sprain | 18 | 23 | 11 | 22 | | 27 | 29 |
| Foreign body | 4 | 1 | 12 | 5 | | 9 | - |
| Burn | 2 | 3 | 4 | 5 | | 4 | 4 |
| Other | 4 | 3 | 9 | 2 | | 5 | 13 |
| Not specified | 16 | 16 | - | - | | - | - |
| TOTAL | 100 | 100 | 100 | 100 | | 100 | 100 |

* Data from Safety and Offshore Oil, 1981 for offshore U.S.A.(14).

\+ Source X - Accident figures for a 1-year period from a confidential source of data referring to an offshore circumpolar petroleum operation.

** USCG - United States Coast Guard's Outer Continental Safety Project for OCS Drilling Industry Accidents(15).

\# WCB (Alberta) - Data from Occupational Health and Safety, Alberta(16).

of "major" and "minor" accident for both drill units and standby/supply vessels. For drill units the next most common type for "minor" accidents was "caught" followed by "slipped/tripped". For "major" accidents "overexertion" was the second most frequent type of accident and "slipped/tripped" was third. For standby/supply vessels on the other hand, "slipped/tripped" and "overexertion" were the second and third most common type of accident for both "minor" and "major" accidents.

The significance of "overexertion" is that frequently it is a cause of back pain. Falling from one level to another, although uncommon, was more apt to produce a "major" than "minor" accident.

Table 6 shows the percentages for type of accident in other parts of the world but again it can be seen that "struck" is the most common type. This study confirms this observation.

### 6.7.7 NATURE OF ACCIDENT FOR DRILL UNITS AND STANDBY SUPPLY VESSELS

For both drill units and standby/supply vessels the nature of the accident was not specified for a significant number of accidents. However, for both drill units and standby/supply vessels, "contusions" were by far the most commonly given description of the nature of accident (Table 5). Lacerations were also common among the "minor" accidents for both drill units and standby/supply vessels. Sprains were second for "major" accident on both drill units and standby/supply vessels, and also for "minor" accidents on standby/supply vessels. The two percent of cases of fractures listed under the drill unit "minor" accidents refer to a clinical impression only.

The nature of the accident section of Table 6 shows that "contusions", "sprains" and "lacerations" are common throughout all the given data sources, in line with the findings of this study.

Table 7 shows the nature of accident for this study subdivided into part of body. This table identifies those parts of the body most prone to fractures, sprains and lacerations. On drill units "lost time" fractures of the upper limb were twice as common as the lower limb. For standby/supply vessels the lower limb was the more frequently fractured. This difference may be related to the hazardous nature of drilling on drill units. The back/neck is by far the most common part sprained, while the upper limb has the most lacerations, but these lacerations do not usually involve lost time. Foreign bodies in the eye, as stated earlier, do not usually involve lost time, but where they do it is only for a short period (less than 4 weeks). Eye injuries are usually due to welding accidents such as foreign bodies and °arc° eye.

### 6.7.8 OCCUPATION ON DRILL UNITS AND STANDBY/SUPPLY VESSELS

FROM [illegible] RECORDS

TABLE 7

NATURE OF ACCIDENT VS PART OF BODY INJURED FOR DRILL UNITS AND SUPPLY/SUPPORT VESSELS SUBDIVIDED INTO "MINOR", LOST TIME ≤4.0 WEEKS AND LOST TIME >4.0 WEEKS

| NATURE OF | PART OF BODY | MINOR (NO LOST TIME) | | "MAJOR" (LOST TIME) (≤4.0 WEEKS) | | "MAJOR" (LOST TIME) (>4.0 WEEKS) | |
|---|---|---|---|---|---|---|---|
| | | DRILL UNITS | STANDBY/ SUPPLY | DRILL UNITS | STANDBY/ SUPPLY | DRILL UNITS | STANDBY/ SUPPLY |
| CONTUSIONS | | 69 | 47 | 35 | 28 | 30 | 21 |
| FRACTURE | HEAD/NECK | 0 | 0 | 0 | 0 | 2 | 0 |
| | UPPER LIMB | 2 | 0 | 3 | 2 | 5 | 2 |
| | LOWER LIMB | 1 | 0 | 0 | 2 | 4 | 4 |
| | BACK | 0 | 0 | 0 | 0 | 1 | 0 |
| | OTHER | 1 | 0 | 1 | 1 | 0 | 1 |
| AMPUTATION | HAND/FINGER | 0 | 0 | 0 | 0 | 3 | 1 |
| SPRAIN | UPPER LIMB | 1 | 5 | 8 | 4 | 2 | 4 |
| | LOWER LIMB | 3 | 2 | 2 | 2 | 4 | 5 |
| | BACK/NECK | 11 | 9 | 7 | 5 | 11 | 9 |
| | OTHER | 1 | 3 | 3 | 2 | 2 | 1 |
| LACERATION | HEAD/NECK | 5 | 2 | 0 | 1 | 1 | 0 |
| | EYE | 1 | 1 | 0 | 0 | 1 | 0 |
| | UPPER LIMB | 17 | 14 | 4 | 3 | 2 | 3 |
| | LOWER LIMB | 2 | 0 | 0 | 2 | 0 | 1 |
| | OTHER | 0 | 0 | 1 | 2 | 0 | 0 |
| BURNS | | 4 | 1 | 3 | 1 | 4 | 0 |
| FOREIGN BODY | EYE | 17 | 3 | 2 | 2 | 0 | 0 |
| | UNSPECIFIED | 1 | 0 | 0 | 0 | 0 | 0 |
| OTHER AND NOT SPECIFIED | | 42 | 14 | 29 | 10 | 11 | 9 |

The distribution of incidence of both "major" and "minor" accidents by occupation for drill units as reported for Rigs A and B is recorded in Table 8. It shows that for "minor" accidents all occupations had accidents except crane operators (Rig A) and subsea engineers (Rig B). On Rig A welders and rig mechanics had the most accidents per employee, followed by roughnecks, roustabouts, derrickmen and electricians. On Rig B the order was roughnecks, roustabouts, welders and caterers. Welders have a high incidence of "minor" eye accidents and caterers are prone to cut themselves.

"Major" accidents occurred only in four occupations, roustabouts and roughnecks on Rig A and roughnecks, drillers and seamen on Rig B. This confirms the observation that of the drilling crew, unskilled labourers and drillers are the most prone to have accidents which involve lost time accidents.

### .7.9 COMPARISON WITH OTHER COUNTRIES

Table 9 gives a comparison of the percentage of total reported accidents for three areas - offshore U.S.A., U.K. North Sea and Rig B. These percentages do not take into account the varying number of employees in each job description but the table can still be used for comparision of percentage of accidents in the three areas. Rig B appears to be comparable to the U.K. for roustabouts and derrickmen, but to the USCG for roughnecks and drillers.

### .7.10 STANDBY/SUPPLY VESSELS

On standby/supply vessels neither the percentage of accidents nor the incidence of "major" and "minor" accidents by occupations could be calculated as neither the number of vessels involved nor their length of time at sea was known. Table 10 shows the actual number of reported "major" and "minor" accidents which occurred in a one-year period for all standby/supply vessels at sea during that year. On the basis of the usual complement on a standby/supply vessel and the total number of accidents per occupation it is apparent that seamen and caterers were the most liable to have an accident. Catering is an occupation known to be at risk for lacerations and traumatic amputations.

TABLE 8

INCIDENCE OF "MAJOR" AND "MINOR" ACCIDENTS BY JOB CLASSIFICATION ON TWO RIGS AVERAGED FOR SIX MONTHS (RIG A) AND 2 2/3 YEARS (RIG B)

| OCCUPATION | RIG A (6 months) | | | RIG B (2 2/3 years) | | |
|---|---|---|---|---|---|---|
| | NUMBER OF PERSONNEL | "MINOR" ACCIDENTS * | "MAJOR" ACCIDENTS * | NUMBER OF PERSONNEL | "MINOR" ACCIDENTS * | "MAJOR" ACCIDENTS * |
| ROUSTABOUT | 17 | 0.44 | 0.12 | 12 | 0.16 | 0 |
| ELECTRICIAN | 5 | 0.39 | 0 | 5 | 0.02 | 0 |
| WELDER | 2 | 0.99 | 0 | 2 | 0.12 | 0 |
| RIG MECHANIC | 2 | 0.99 | 0 | 4 | 0.06 | 0 |
| CRANE OPERATOR | 5 | 0 | 0 | 8 | 0.05 | 0 |
| ROUGHNECK | 12 | 0.69 | 0.13 | 12 | 0.29 | 0.02 |
| DERRICKMAN | 5 | 0.39 | 0 | 4 | 0.06 | 0 |
| DRILLER | 10 | 0.16 | 0 | 8 | 0.08 | 0.01 |
| SUBSEA ENGINEER | 3 | 0.26 | 0 | 3 | 0 | 0 |
| ABLEBODIED SEAMAN | 4 | 0.20 | 0 | 4 | 0.08 | 0.02 |
| CATERING CREW | 19 | 0.29 | 0 | ?+ | 0.11 | 0 |
| OTHER | 39 | 0.43 | 0 | 38 | 0.07 | 0 |
| TOTAL | 123 | | | 100 | | |

* Accidents expressed as number per month per employee in each job description.

\+ Assumed catering crew on Rig B is same as Rig A.

NOTE:

1. Calculations based on number of crew offshore at any time being half the above number.

2. The above number of personnel is quoted from the drilling companies, so does not include employees of other companies working on the rig.

3. Because of (2) the numerical values in above table may be falsely elevated (especially in the case of 'other'). The above figures have been calculated on the numbers given by the drilling companies.

TABLE 9

PERCENTAGE OF TOTAL ACCIDENTS ON DRILL UNITS BY OCCUPATION

| OCCUPATION | U.S.C.G. (3 years) | RIG B (2 2/3 years) | U.K. (5 years) |
|---|---|---|---|
| ROUSTABOUTS | 30.4 | 16.3 | 14.5 |
| ROUGHNECKS | 24.1 | 30.1 | 17.5 |
| DERRICKMEN | 7.9 | 2.0 | 4.0 |
| DRILLER | 5.4 | 5.9 | 4.0 |
| OTHER | 32.2 | 45.1 | 60.0 |
| TOTAL | 100.0 | 100.0 | 100.0 |

U.S.C.G. - United States Coast Guard's Outer Continential Safety Project for OCS Drilling Industry Accidents.(15)

U.K. - Data obtained from Professor Norman's Interim Report.

TABLE 10

"MAJOR" AND "MINOR" ACCIDENTS (BY JOB CLASSIFICATION) ON STANDBY/SUPPLY VESSELS AVERAGED FOR ONE YEAR

| OCCUPATION | NUMBER OF PERSONNEL PER SHIP | NUMBER OF ACCIDENTS FOR ALL SHIPS | "MAJOR" | "MINOR" | UNSPECIFIED |
|---|---|---|---|---|---|
| SEAMAN | 8 | 23 | 21 | 2 | 0 |
| OILER | 2 | 2 | 2 | 0 | 0 |
| ENGINEER | 3 | 0 | 0 | 0 | 0 |
| MATE | 2 | 0 | 0 | 0 | 0 |
| MASTER/BOSUN | 2 | 1 | 1 | 0 | 0 |
| CATERING | 2 | 5 | 2 | 1 | 2 |

NOTE:

1. Number of personnel calculated as average from listing of personnel on 8 supply ships.

2. Information obtained from Claims Summary Sheet A supplied by the petroleum company and from WCB for the lost-time.

3. The data applies for one calender year.

4. No information available on the number of ships and thus the population at risk is not known.

5. The "minor" accidents is a minimum value as only those accidents which might lead to a future claim are included in this data.

.8 **SUMMARY- PART II**

1. "Minor" (no lost time) accidents greatly out numbered "major" (lost time) on the Newfoundland drill units by at least 12 to 1. There was one fatality from a standby/supply vessel.

2. "Major" accidents when subdivided on the basis of those up to 4 weeks lost time and those over 4 weeks divided equally for both drill units and standby/supply vessels.

3. For both drill units and standby/supply vessels the part of the body most frequently injured was, as reported by others, the hand/wrist. The eye was a frequent site of "minor" accidents.

4. The commonest type of accident experienced by drilling employees on drill units and standby/supply vessels as reported by others, was "struck by". This concurs with the findings from other studies. "Overexertion" in association with "back sprain" was also quite common.

5. The most common reported nature of the accident was "contusion". This concurs with the findings in other studies.

6. On the Canadian East Coast rigs all occupations except crane operators and subsea engineers had varying numbers of minor accidents but for major accidents only roustabouts, roughnecks, drillers and seamen were affected.

7. On standby/supply vessels seamen and caterers had the most accidents.

## REFERENCES


1. Simpson, S; "Health and Safety Offshore in the U.K. Sector", World Offshore International Petroleum Times, April 15, 1980, pp. 24-30.

2. "Safety and Offshore Oil", Committee on Assessment of Safety of OCS Activities, Marine Board, Assembly of Engineering, National Research Council, National Academy Press, Washington, D.C., 1981, pp. 134-140.

3. Friis, D.A.; "Accident Statistics for Mobile Offshore Drilling Units: An Examination and Analysis", Unpublished Paper - Faculty of Engineering and Applied Science, Memorial University of Newfoundland, June 1982.

4. "Risk Assessment - A Study of Risk Levels Within Norwegian Offshore Petroleum Activities"; The Royal Norwegian Council for Scientific and Industrial Research, November 1979, Report No. 26-2712, pp. 71-120.

5. Boucheny, L; "The Risk of Accident in the Oil and Gas Extractive Industries Offshore," EEC Symposium on Occupational Health and Safety of Workers in the Petroleum Extractive Industry, April 19, 20, 1983.

6. Carson, W.G.; "The Other Price of Britain's Oil, Safety and Control in the North Sea", Martin Robertson, Oxford, 1982.

7. "Chapter 3 - 'Experience in the Industry of Fatalities, Serious Accidents and Dangerous Occurrences Areas of Particular Danger'"; Offshore Safety Report by Burgoyne Committee, March 1980.

8. Chapter III - 'Safety Problems in the Offshore Petroleum Industry'; International Labour Office, Geneva, 1978.

9. Rutenfranz, J; Knauth, P; Angersbach, D; "Shiftwork Research Issues. The Twenty-Four Hour Workday"; Proceedings of a Symposium on Variations in Work-Sleep Schedules, pp. 221-252.

10. Walker, J; "The Human Aspects of Shiftwork", 1978, Institute of Personnel Management, Central House, Upper Woburn Place, London, England.

11. Baker, D; "The Use and Health Consequences of Shiftwork", Int. J. Health Services, (10, 3) 1980, pp. 405-420.

12. Aschoff, J; Hoffman, K; Pohl, H; Weaver, R; "Re-entrainment of Circadian Rhythms After Phase Shifts of the Zeitgeber" Chronobiologia, 1975, 2, pp. 23-78.

13. Hendry, W.J.; (1978) "The Offshore Scene and Its Hazards". In: Mason, J.K. (ed); Pathology of Violent Injury. Edward Arnold, Illinois, pp. 297-317.

14. Whitman, John E.; "Survey of Past Time Occupational Injuries Occurring on Conoro Operated Properties in OCS Waters", in Safety and Offshore Oil: Background Papers of the Committee on Assessemt of Safety of OCS Activities, Marine Board Assembly of Engineering, Natural Research Council, National Academy Press, Washington, D.C., 1981, pp. 169-179.

15. Whitney, Stearns H.; "Drill Rig Accidents", in Safety and Offshore Oil: Background Papers of the Committee on Assessment of Safety of OCS Activities, Marine Board Assembly of Engineering, National Research Council, National Academy Press, Washington, D.C., 1981, pp. 155-167.

16. Alberta Oil and Gas Industries, "Analysis of Work Injuries and Illnesses", Appendix A, Occupational Health and Safety, Alberta, February 1983, 83-084/R.

# SELECTED BIBLIOGRAPHY

## Bibliography

Protection of Workers Against Noise and Vibration in the Working Environment, International Labour Office, Geneva, 1977, ISBN 92-2-101709-5.

Alberta Oil and Gas Industries: Analysis of Work Injuries and Illnesses; Carmen Gibeau, Research Branch Occupational Health and Safety Division, February, 1983.

Men and Materials Handling in Offshore Operations; H.A. Opbroek; pp. 257-266.

Risks of the Offshore; News, Petrol Informations October 16, 1980, pp. 22-23.

Hazards of Offshore Operations Appraisal and Control, H.F. Grorud and C. Boe, Det norske Veritas, Oslo, Norway; Automation in Offshore Oil Field Operations, eds. Galtung, Rosandhaug and Williams North-Holland Publishing Company, 1976, pp. 103-108.

Tracing the Causes of Rig Mishaps, Leonard LeBlanc, Offshore, March 1981, pp. 51-62.

Symposium on Trauma and Rehabilitation in the Oil-Related Industries, Reprinted from Scottish Medical Journal 1982; 27i: pp. 277-278 and 351-365.

Noise Control on Offshore Platforms, T.H. Melling and R.J. Davies; Offshore Services, November 1974.

Noise and Vibration Control Procedures for Offshore Installations: Guidance for Project Managers; UEG Report UR19.

Noise on Offshore Platforms, T.H. Melling; Noise Control and Vibration Reduction, July 1975.

Noise on Offshore Platforms, Brian C. Ross, BSc, MInstP, Lecturer Glasgow College of Nautical Studies, Occupational November 1978.

Burgoyne, J.H.; Offshore Safety, Report of the Committee, HMSO London, U.K., March 1980.

The Occupational Health and Safety Regulations, 1979, Department of Labour and Manpower, Newfoundland.

Newfoundland Regulation 149/82, Newfoundland and Labrador Petroleum Drilling Regulations, 1982 under The Petroleum and Natural Gas Act and The Occupational Health and Safety Act (O.C. 68-82), Filed June 8, 1982.

Refurbishing North Sea Offshore Living Quarters, Neil Potter; North Sea Observer, No. 7/8, 1981.

Latest Platforms Set New UK Standards for Quarters, Neil Potter; North Sea Observer, No. 9, 1980.

Designing Living Quarters for the North Sea, North Sea Observer; May 27, 1983, No. 5.

OTC Report 1; The Oilman, May 1983.

Medical Aspects of Offshore Oil; Paper submitted in fulfilment of the Community Medicine Tutorial Project; submitted by Lois Bowden.

Rode, A.; Cold: Special Aspects in the Canadian North, NRCC No. 20640.

Chapter 7

# HEALTH CARE RESOURCES OFFSHORE

## 7.1 INTRODUCTION

The health care resources available offshore include the sick bay facilities, medical supplies and equipment maintained on board the MODU, and the lifeboats and liferafts. Other resources such as the health care personnel on board the MODU and the health care supplies and facilities on board the standby/supply vessels are reviewed in other sections.

## 7.2 SICK BAY FACILITIES

The location, size and services of the sick bay should be carefully considered during the design stage of the drilling unit. Physicians and others experienced in designing hospital facilities could provide valuable advice to the unit°s designers.

### 7.2.1 LOCATION OF THE SICK BAY

For the location of the sick bay there are four important considerations (1):

i) The sick bay should be easily accessible to a party carrying a stretcher. Difficult stairways or ladders, and narrow corridors with sharp bends or double doors should be kept to a minimum.

ii) Further the sick bay should be located in reasonable proximity to, and on the same level as the helipad in order to facilitate the transfer of sick or injured patients to and from the helicopters. The sickbay should have ready access from the drill floor where most injuries occur.

iii) The sick bay should be sited away from continuous major pedestrian traffic or high noise levels, such as engine rooms, laundry or food preparation facilities.

iv) There should be a large space adjacent to the sick bay such as a recreational lounge or dining area which, in an emergency, can accomodate large numbers of casualties and serve as a triage area. Casualties should be kept together so that they are not left unobserved, as could happen if they were accommodated in a number of small cabins.

The area used for the triage of multiple casualties should have a separate means of direct access to the sick bay although this route need not be available for routine use.

### 7.2.2 SIZE

The size of the sick bay should be determined by the complement of the MODU or fixed installation and, since space is at a premium, it is unlikely that the optimum size suggested for offshore hospital design can be achieved.

In the UK sector of the North Sea the Health and Safety Executive have published recommendations for the size of sick bays as follows:

i) regular complement up to 25 persons - sick bay 2 metres by 3 metres,
ii) regular complement more than 25 but less than 100 - sick bay 5 metres by 7 metres,
iii) regular complement more than 100 - sick bay 10 metres by 7 metres.

### 7.2.3 SERVICES IN THE SICK BAY

The sick bay will require certain services including hot and cold running water, electrical services, toilet and sewage facilities and piped medical gases. The specifications of these services will not be outlined in detail since they are readily available in published standards applicable to hospital construction.

The specifications should include good sound insulation, adequate storage space for medications and equipment, easily cleaned sink and toilet area, adequate work surfaces, emergency lighting, ventilation and air temperature control, and facilities for disposal of contaminated material (2).

### 7.2.4 COMMUNICATIONS SYSTEMS

The communications system should allow the medic to speak directly from the sick bay to the company physician onshore and to confer directly with the installation manager or ship's master when necessary. Preferably he should be provided with a system which allows him to have his hands free for carrying out procedures while talking. A detailed discussion of internal communications systems is presented in section 10.1.3 "Communications in Health Care and Safety".

## 7.3 MEDICAL EQUIPMENT AND SUPPLIES FOR THE MODU SICK BAY

Although it is agreed that a minimum level of health capability must be available offshore, any medic, physician, or group of physicians will have personal preferences as to the medical equipment which should be available in the sick bay of a drilling unit. Thus it is difficult to develop a list which will represent the consensus of all the physicians and medics as a good case can be made for the inclusion or exclusion of many items depending on the individual's medical background and point of view.

At present, offshore drilling units on the Canadian East Coast are inspected and subsequently approved by COGLA and NLPD on an individual basis. The consequent lack of standardization of equipment on site hinders contingency planning for the equipment required by Medical Emergency Response Teams.

The company decides whether an individual with a minor medical problem is to be treated offshore or to be evacuated to an onshore medical facility. As the policy for management of minor medical problems varies from company to company the medicaments and equipment specified to be held in the sick bay for treating such conditions will be tailored to suit the company's policy.

However, adequate medical supplies and equipment to cope with emergency and life threatening situations must also be immediately available to ensure that seriously ill or injured individuals can be treated in a manner consistent with the most favourable outcome.

It is suggested that the regulatory agencies should assume the responsibility to frame minimum standards for medical equipment and supplies to be held on each drilling unit licensed to operate on the Canadian East Coast.

Independent of company policy, a basic list should be drawn up of medical equipment and supplies to manage and treat the type and nature of illness and injuries which can reasonably be anticipated to occur in the offshore and involving either an individual or mass casualties.

In developing a medical equipment and supplies list, a distinction must be made between the equipment and supplies needed by the medic, the company physician and the Medical Emergency Response Team. This list is not intended to result in lavishly equipped facilities as it may be useless or even dangerous to provide the medic with equipment which he has not been trained to use properly.

All medications should be kept in a securely locked container and the key should be retained by the medic or, in extenuating circumstances, by the toolpusher or the master. It is important that the expiry dates of medications and medical supplies be monitored by the medic and/or company physician.

The suggested standard list of medical supplies and equipment, especially for serious/emergency medical conditions presented in Appendix 7-A was developed by reviewing the U.K. guidelines, and BP Limited, (North Sea), Shell, Petro Canada and others (6)(7), equipment and supplies lists.

## 7.3.1 MEDICAL EQUIPMENT FOR THE SICK BAY

At present it is controversial whether ECG machines, ECG defibrillators, and X-ray apparatus are necessary equipment for the sick bay. The decision to furnish the sick bay with such equipment depends upon the training and qualifications of the medic to operate the machines safely, the anticipated frequency of use, and the degree to which the findings will aid in prescribing the immediate treatment of life threatening medical conditions.

It is standard practice in North America to teach all nurses Basic Cardiac Life Support (BCLS) and nurses who work in critical care areas receive Advanced Cardiac Life Support (ACLS) training. Similarly various classes of paramedics are taught BCLS and ACLS. The training standards set by the Canadian Heart Foundation for ACLS require the individual to be able to use monitors, defibrillators and to be able to diagnose correctly dysrhythmias from the ECG. Therefore if the rig medic has been trained to the ACLS standard, an ECG monitor and defibrillator could be provided offshore.

Rig medics with RN, TQ6B or paramedic qualifications are not trained in the safety and technical aspects of taking X-rays. While medics could be trained in basic X-ray technology, the range of their skills would be limited to identifying limb fractures, etc. Furthermore, the equipment is expensive, heavy, and bulky. There is insufficient evidence for the safety, utility and efficacy of the X-ray machine to recommend it as standard equipment for use offshore.

## 7.3.2 ADDITIONAL MEDICAL SUPPLIES FOR THE MODU SICK BAY

In addition to the equipment and supplies listed in Appendix 7-A which have obvious medical applications, there are many ordinary items such as blankets, clean sheets and pillows, which must be maintained offshore for use in a medical emergency. The number of blankets required will be determined by the number of hypothermic casualties which can reasonably be anticipated in an offshore accident. At one extreme, it is possible that the entire crew (80-90 persons) of a neighbouring MODU might be rescued from the sea. However, the likelihood of such an occurrence is low given the low probability of survival in the climatic conditions of the Canadian East Coast.

Under more usual circumstances, only one or two hypothermic casualties need be anticipated from man overboard situations. A reasonable worse case to be anticipated would be that the 18 to 22 persons constituting the crew and passengers of a downed helicopter, suffering from some degree of hypothermia might be transported to the MODU or installation for treatment.

Similarily, it is important that there be sufficient clean sheets to minimize contamination of burn victims. If an adequate number of water burn gel blankets or other devices are not available,

burn victims can be cared for as a first aid measure in sheets covered with silver sulfa diazine cream moistened with saline. The number of sheets needed for burn victims is difficult to estimate as the casualties from a major fire or explosion are likely to range from fatalities to severe, moderate and mild burn injuries.

In addition to these supplies, the sick bay must be adequately stocked with such items as facecloths, towels, urinals, basins or containers for vomit, etc.

## 7.4 TYPES OF STRETCHERS ON THE MODU

On offshore MODUs or installations, several types of stretchers are required to facilitate handling and transferring casualties with various injuries under a variety of conditions and arising in remote and inaccessible places to the sickbay or a designated transfer site such as the helideck. An appropriate schedule of inspection should be specified to ensure that stretchers are kept in a state of readiness for emergency use.

Four types of stretchers and their applications will be reviewed (3).

### 7.4.1 GENERAL PURPOSE RESCUE STRETCHER

The general purpose rescue stretcher is the main type of stretcher needed on MODUs or installations and should have the following characteristics:

i) Flotation, as it may be used to transport patients over water between the supply vessel and the drilling unit, or for transport to onshore facilities.

ii) Independent sling capacity to allow for transfer using helicopter or crane.

iii) Fitted patient restraints to ensure safety during transfer.

iv) Construction of non-metal materials to prevent corrosion in storage and to prevent injuries to the hands of bearers due to freezing spray while in use.

v) Comfort, as it will be used for long periods when transporting patients to onshore medical facilities.

vi) Ready access to the patient while he is on the stretcher.

vii) Capacity to accommodate a Neil-Robertson, Paraquard or Orthopaedic Scoop stretcher.

An example of a general purpose rescue stretcher is presented in Figure 1.

## 7.4.2 SPECIALIZED TYPES OF STRETCHERS

In addition to the general purpose rescue stretcher, several types of specialized stretchers may be useful in the offshore, to deal with specific injuries or to permit removal of a victim from difficult locations.

### a. The Neil-Robertson Stretcher

The Neil-Robertson stretcher, which is made of a fabric and cane, (Fig. 2) is designed for use in difficult situations where the patient has to be lowered or lifted. It has well proven reliability and is widely used onboard ships, in rescue work on cliff faces, mountains, air/sea rescue and in many large industrial undertakings due to its easy use, versatility, and ease of assembly. In the offshore environment it is suitable for lowering the patient to the drill floor from high above it. One disadvantage of this stretcher is the lack of rigidity in its main frame which makes it less suitable for cases where there is a suspected broken back.

### b. The Paraguard Stretcher

The Paraquard stretcher (Fig. 3), an alternative to the Neil-Robertson stretcher, was designed for use in many kinds of industrial situations and has found widespread acceptability in the North Sea oil industry. The stretcher has patient restraints and its narrow and rigid back makes it suitable for moving victims with suspected back injury. It has a strong lifting sling and is fitted with a guide rope, making it suitable for helicopter work. It can be turned over in the event of vomiting during transfer, thus avoiding airway contamination. It fits snugly into a backpack making it easily accessible and portable but it can be complex to assemble, and training is required in packing and assembly.

### c. The Orthopaedic Scoop Stretcher

The Orthopaedic Scoop stretcher (Fig. 4) may be used to lift a victim with a possible back injury. It can be closed beneath the victim and literally scoops him up,

FIGURE 1

GENERAL PURPOSE RESCUE STRETCHER

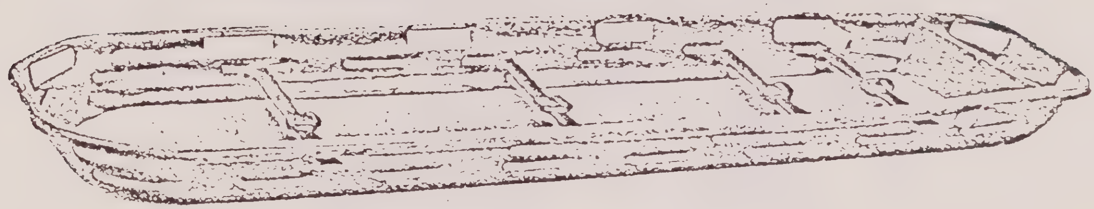


FIGURE 2

NEIL-ROBERTSON STRETCHER

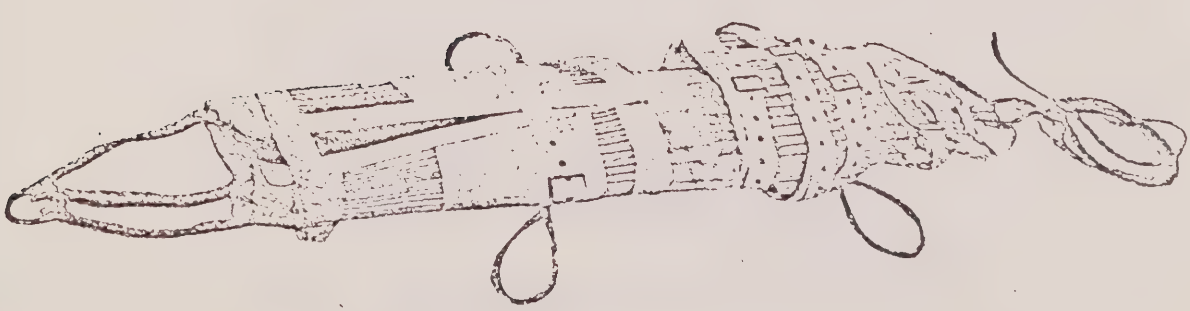


FIGURE 3

PARAGUARD STRETCHER

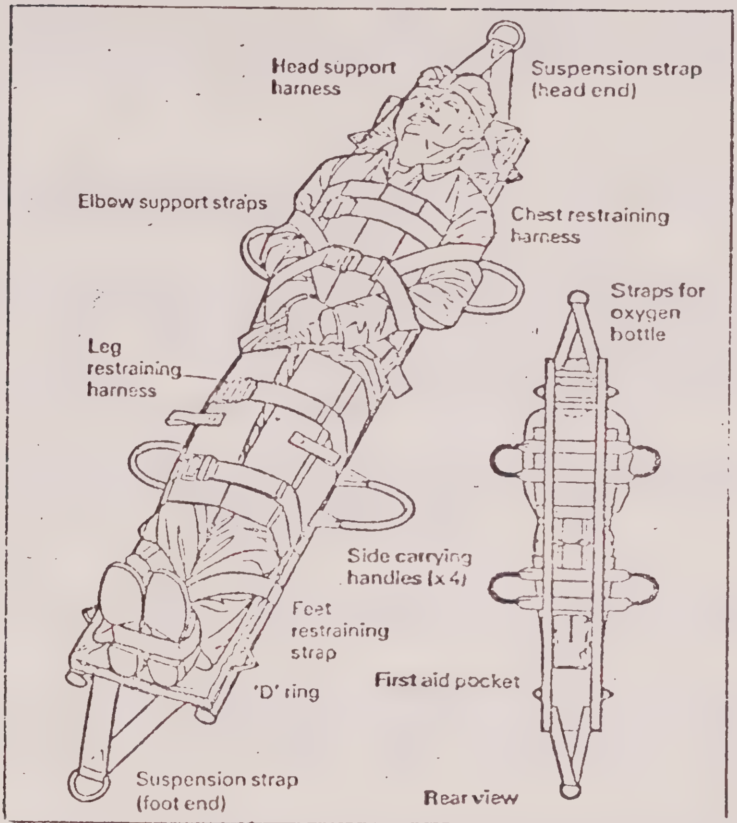
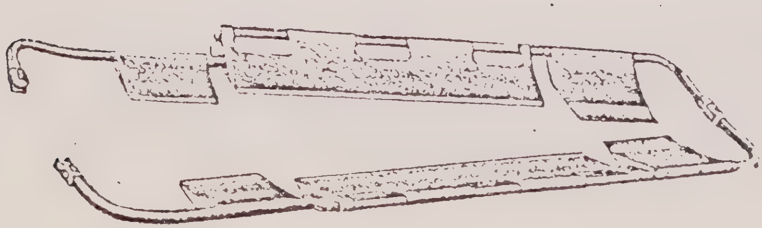



FIGURE 4

ORTHOPAEDIC SCOOP STRETCHER



thereby obviating harmful movements which may be caused by unnecessary or inexpert lifting. It can be used to transport the victim from the scene of the accident to a rescue stretcher, but its inherent instability makes it unsuitable for transport over long distances.

## 7.5 CONCLUSIONS

Ideally, the types of stretchers available on offshore MODUs or installations should be standardized.

It is suggested that one Orthopaedic Scoop and one Neil-Robertson or Paraguard stretcher are needed on an offshore MODU or installation with rescue stretchers distributed at various sections. The exact number of stretchers would depend upon the number of personnel. Cox (2) suggests that on a semisubmersible with a crew of 85 persons 10 stretchers are desirable.

For transporting casualties via helicopter the Paraguard, the Neil-Robertson, and the Orthopaedic Scoop stretchers are best used in association with a rescue stretcher.

An appropriate period should be specified for regular inspection of stretchers especially these located in high risk areas, such as the drill floor.

If standardization of the type of stretchers is not possible First Aid training should include instruction on the use and limitations of the types of stretchers available on the vessel or drilling unit.

## 7.6 SURVIVAL PROBLEMS AND MEDICAL SUPPLIES IN LIFEBOATS AND LIFERAFTS

Evacuation of a MODU by lifeboat or liferaft has not proven to be significantly effective in such disasters as the Alexander Kielland and the Ocean Ranger. Furthermore occupants of successfully launched lifeboats or liferafts may experience major problems in survival such as thirst, hunger, motion sickness, exhaustion, hyperthermia, hypothermia and heat stroke. It has also been recognized for some time that the morale of the survivors has a major effect on the outcome.

### 7.6.1 PROVISIONING OF LIFEBOATS

In provisioning lifeboats or liferafts with water, food, thermal clothing, first aid supplies and equipment, a compromise must be made between space, weight, cost and the probable time to rescue. Current provisioning scales of food and water are adequate in the context of oil exploration off Canada's East Coast as the time to rescue is likely to be relatively short since the location of any

MODU or installation will be known with great accuracy, there are standby/supply vessels in the area and any untoward incident would be immediately reported to the company's shore base. MODUs have good communication with shore and other vessels and modern technology in the form of automatic radio beacons should substantially assist any search.

### 7.6.2 SURVIVAL PROBLEMS IN LIFEBOATS AND LIFERAFTS

The provisioning of lifeboats or liferafts with thermal clothing, first aid supplies and equipment will be reviewed and suggestions proposed in light of the following medical conditions which may present during abandonment:

a. Trauma

Any survivor could be traumatized in the course of a disaster or while attempting to abandon the MODU. Thus it is highly probable that fractures, head injuries and blunt injuries to chest and abdomen as well as lacerations and haemorrhage would occur and would require immediate treatment while awaiting rescue.

To abandon a ship, MODU or installation by a liferaft, the usual practice is to throw the raft overboard and jump after it when it has inflated. Due to the very high deck levels on MODUs there is a serious risk of trauma from incorrect entry into the water, and of trauma to the cervical spine from an incorrectly worn lifejacket. Further, trauma can result from impact with debris or other survivors in the water, or with the structure, ropes, and other gear during the jump.

In the lifeboat, which is manned before being lowered, there is a risk of trauma, particularly to the spinal column, if the lifeboat is dropped inadvertently from a height. Such an accident could result in substantial numbers of injuries. First Aid would consist of immobilizing each victim, splinting him with a back board, and careful lifting and turning, all of which would be difficult in a lifeboat in a heavy sea.

Although the research on the new "free fall" lifeboat (4) in Norway has not yet been fully documented, there appears to have been no instance of back injury (or of any serious injury) during testing. This is probably due to two factors: 1) the boats are designed to keep the inertial forces (G-forces) encountered on falling from a height at levels within the human tolerances established from aerospace research and development, and 2), the seats and seat belts in these boats were designed with due regard to orthopaedic considerations, and include head restraint and curved backs which correctly position the spine so that impact forces may be best resisted.

b. Hypothermia

Some of the medical implications of hypothermia (5) are:

(a) Hypothermia occurs when the core temperature of the body falls to 35°C and the condition carries a high mortality.

(b) Shivering and muscle tension increase heat production, but can lead to exhaustion. Significant heat loss occurs from the uncovered head. Heat loss is increased by wind chill and water turbulence.

(c) The effects of exposure to cold include respiratory changes, increased cardiac output, diuresis, hypertension and cardiac dysrhythmias. With prolonged exposure, the victim may become confused and disoriented. Diuresis and oedema can lead to shock.

(d) The immersed victim may drown because of muscle rigidity or loss of consciousness, or may die from shock or cardiac arrest.

(e) Even after rescue, the victim may die because cooling continues and cardiac arrest may occur because of stimulation to the chest during rescue.

On the Canadian East Coast there is a high probability that any survivor who has been in the water in winter without a survival suit would be hypothermic and may also be suffering from near-drowning. Even in the lifeboat or liferaft, there is a danger of the rapid onset of hypothermia. To prevent this, survivors should huddle together, try to keep dry and avoid wind chill. Morale is an important factor in instituting these elementary safeguards. The feasibility of storing extra thermal clothing on board the lifeboat for those who may not have time to suit up prior to abandoning the drilling unit should be considered.

The design of protective clothing used in work and helicopter travel as survival suits, needs more consideration to combine the requirements for manoeuverability of the wearer, the degree of thermal protection offered, and the buoyancy and flotation characteristics of the garment (5).

Only lifeboats which are covered are likely to be useful in Eastern Canadian waters in winter. The reports from the Fastnet and Ocean Ranger disasters suggest that inadequacies in the design, construction and maintenance of liferafts may combine to provide poor defence against hypothermia. Specifically, a thin rubber floor does not insulate the survivors from the cold of the sea. Any tendency of the raft to ship water soaks the occupants and reduces the thermal protection from their garments. In addition there is

evidence that the fabric covers of liferafts easily tear and become ineffective in use, thus exposing survivors to wind chill.

The direct effects of hypothermia will be exaggerated by dehydration resulting from vomiting due to motion sickness.

Because of shivering, muscle rigidity and loss of strength, a hypothermic man is incapable of the feat of agility needed to board many current liferafts from the water. The hazards involved in rescuing a hypothermic victim from the water, when factors such as continued cooling, loss of hydrostatic support and stimulation of the chest are present, may lead to death after rescue.

For additional information on hypothermia refer to "Hypothermia" by Manson in the Related Papers Report.

c. Frostbite and Trench Foot

Survivors in a lifeboat, or particularly in a liferaft, are at risk from frostbite and "trench foot".

Frostbite occurs when some of the body tissues freeze. Because of the high concentration of dissolved solutes in tissue fluids this freezing does not occur until well below 0'C, and is more likely to result from exposure to wind chill rather than directly from immersion. Frostbite may be partially prevented by keeping the extremities as dry as possible, donning thermal clothing prior to evacuation, avoiding tight clothing which restricts the circulation, by avoiding cramped positions, and by constantly moving the limbs in an effort to maintain the circulation. When it does occur, the affected parts should be kept dry (further cooling must be avoided), and, after rescue, the frostbitten areas should be rewarmed rapidly. Without such measures gangrene may result.

"Trench", or "immersion" foot is a lesser degree of cold injury to an extremity which may be prevented in the same manner as frostbite.

A supply of extra immersion suits for use by survivors who have not donned their suits before abandoning could help to reduce these effects.

It is well known that morale, which affects the will to take the necessary preventative action, has a marked effect on the incidence of frostbite and "immersion foot".

d. Heat Stroke

In Eastern Canadian waters heat stroke is not a likely problem with lower environmental temperatures. Consequently, sweating and evaporative heat loss are less, and dehydration and thirst are slower in onset than in tropical or subtropical waters. Nevertheless adequate supplies of drinking water must be provided on lifeboats.

e. Motion Sickness

Seasickness is regarded as an uncomfortable, embarrassing or distressing condition, but it is not generally appreciated that it represents a major hazard to survival. Motion sickness can affect an individual floating in an immersion suit, and is a particular problem in liferafts. Lifeboats, which are more stable than liferafts, tend to produce fewer problems of motion sickness.

The major problems of motion sickness which have been described are:

i) A dangerous loss of morale is often experienced which causes the victim to neglect preventative actions for his own safety. In severe cases, he may be uncooperative, unmindful of the needs of others, preferring simply to huddle in his own misery, uncaring whether he lives or dies.

ii) Prolonged vomiting is an unproductive physical effect, which results in dehydration, due to the loss of gastric and upper intestinal secretions. In its turn, dehydration reduces circulating blood volume, predisposing the victim to shock, particularly when there is blood loss from injuries or hypothermia (which itself causes fluid to be lost from the circulation). Vomiting also causes loss of electrolytes causing an electrolyte imbalance in the body fluids.

Severe motion sickness can in fact be life-threatening and preventative action should be taken. Pharmacological prevention is the most practical method. The modern drugs, available in Canada, for prophylaxis and therapy of motion sickness which are listed in the Compendium of Pharmaceuticals and Specialties, 18th Edition, 1983 (Canadian Pharmaceutical Association, Ottawa), are given in Table 1.

A major problem is that all the effective drugs depress the activity of the central nervous system and produce some degree of drowsiness, itself a potential hazard.

TABLE 1

DRUGS USED FOR PROPHYLAXIS AND THERAPY OF MOTION SICKNESS

| DRUG | MANUFACTURER | GENERIC NAME | CLASS | COMMENT |
|---|---|---|---|---|
| Donnatol | Robins | Belladonna alkaloid & Phenobarbital | | Oral administration only. Barbiturate component may produce excessive sedation. May cause blurred vision. |
| Dramamine | Searle | Dimenhydrinate | Antihistamic Sedative | Oral administration see Gravol |
| Emetrol Liquid | Rorer | Phosphorated carbonates | | Oral administration. Only moderately effective. No CNS effects. |
| Gravol | Horner | Dimenhydrinate | Antihistamic Sedative | Oral/I.M. Rectal preparations. Sedative and CNS depressant effects cause drowsiness. Will potentiate effects of a scopolamine (Hyosine |
| Torecan | Sandoz | Thiethylperazine | Phenothiazine Sedative | Oral/I.M. Rectal preparations. Sedative and CNS depressant may produce drowsiness and decreased alertness. |
| Transderm-V | CIBA | Scopolamine (Hyoscine hydrobromide) | Belladonna alkaloid | -Transdermal administration<br>-Sustained administration over 3 days after initial priming dose to rapidly establish therapeutic levels<br>-May cause some blurring of vision and mild drowsiness.<br>-Affects memory.<br>-Rarely, mental confusion etc.<br>-Best results achieved if applied up to 12 hours before exposure.<br>-Will potentiate effects of dimenhydrinate. |

Source: Compendium of Pharmaceuticals and Specialties, 18th Edition, 1983 (Canadian Pharmaceutical Association, Ottawa)

While extensive research has been conducted to improve anti-motion sickness drugs, the effectiveness of hyoscine, one of the oldest drugs in use, has not yet been surpassed. At the usual dose, hyoscine, as a belladonna alkaloid, affects the pupil size and the ability to focus the eye, but this effect is practically tolerable in most people. Hyoscine causes dryness of the mouth, and may cause difficulty in initiating urination in persons with prostatism. It is contraindicated in the eye disease glaucoma. Hyoscine inhibits sweating, but this should not be a severe problem in the Canadian East Coast. At higher doses, hyoscine may affect memory and produce restlessness and even hallucinations in susceptible individuals.

Once vomiting is established, oral preparations (taken by mouth) may not be effective, since they are often vomited before they can be absorbed by the body. A major advantage of hyoscine is that it can be given as a transdermal preparation "Transderm-V" (absorbed through the skin). Alternatively, treatment can be by the use of dimenhydrinate suppositories. If both these alternatives to the oral route are used, the effects of hyoscine and dimenhydrinate will potentiate each other, and the patient may become very drowsy and ataxic (clumsy). In such a situation it may be necessary to remove the Transderm-V patch. Because of the risks of side-effects, treatment of motion sickness should be administered or supervised by an individual with advanced First Aid training.

## .6.3 MEDICAL SUPPLIES AND EQUIPMENT FOR LIFEBOATS AND LIFERAFTS

The current requirements, under the Canada Shipping Act Regulations, for medical equipment for lifeboats and liferafts are set out in Table 2.

The most obvious omission from the requirements is a means of preventing or treating motion sickness. Ideally, a motion sickness prophylactic such as the Transderm-V system, should be packed with each immersion suit, and a stock held in both lifeboats and liferafts. The First Aid kits should also include some such preparation as Gravol suppositories (dimenhydrinate).

In addition to supplies of bandages and dressings which at present are specified for lifeboats only, antiseptic cream to treat superficial infected wounds would be a useful addition to the lifeboat First Aid kit.

Petroleum jelly, which is carried in the lifeboat First Aid kit, is useful for removing fuel oil, etc., from the eyes and mouth. Smeared on the face, it will also help to prevent salt water sticking to the face and freezing. It is suggested petroleum jelly should also be included in the first aid kit on liferafts.

A general-purpose antibiotic, with a broad spectrum and low

TABLE 2

CANADA SHIPPING ACT REGULATIONS

| ARTICLE | LIFEBOAT | LIFERAFT | COMMENTS |
|---|---|---|---|
| a) Collapse reviver | 6 | Nil | |
| b) 1/8 grain compound codeine tabs | 50 | 50 | A reasonable choice of analgesic. Little emetic properties, low abuse potential |
| c) First field dressings or standard dressings No. 14 | 2 | 4 | as for (h) |
| d) Shell dressings or standard dressings No. 15 | 2 | 4 | as for (h) |
| e) Elastic adhesive dressings each 2x3 inches | 6 | Nil | Surely useful in a liferaft: see item (h) |
| f) Illustrated triangular bandages each with 38" sides and 54" base | 5 | 4 | |
| g) White absorbent gauze 36"x2 1/2" x 4 yards | 3 | Nil | Surely useful in a liferaft: see item (h) |
| h) Roller bandages each 2 1/2"x4 yards | 4 | 10 | Higher numbers in liferaft may offset lack of items (e), (g), (i) and (j) |
| i) Unbleached calico bandage 6"x6 yards | 1 | Nil | see item (h) |
| j) Cotton wool | 4 oz | Nil | see item (h) |
| k) Safety pins | 6 | Nil | Hazard in liferaft. Could waterproof adhesive tape be substituted? |
| l) Petroleum jelly | 1 oz | Nil | Useful in liferaft |
| m) Scissors | 1 pair | 1 pair | Should be blunt pointed in liferaft |
| n) Energy tablets 10 mg | 60 | Nil | |
| o) Silica gel | 1 capsule | Nil | Intended to keep contents dry |
| p) Waterproofed set of First Aid Instructions in both English and French | 1 | 1 | |
| q) Cetrimide antiseptic cream | Nil | 2 oz | Useful in lifeboat |

Source: Canada Shipping Act Regulations

incidence of allergy, might also be useful for contaminated wounds, and the treatment of near-drowning. Safety pins and pointed scissors may produce tears in the fabric of a liferaft and alternatives should be provided.

These lists of supplies and equipment should now be metricated and, in particular, drug dosages expressed in milligrams, as many younger physicians and health workers are now totally unfamiliar with dosages expressed in grains.

## 7.7 TRAINING

Training of personnel in personnel survival techniques, the use of the lifeboat and liferaft equipment, and the procedures to be followed will maximize chances of survival and rescue (4). Such training can also improve morale in the event of abandonment and may reduce the occurrence of hypothermia, frostbite and immersion foot. It is suggested that all personnel should be trained to don an immersion suit when preparing to abandon the MODU or installation by lifeboats or liferafts.

In Chapter 9 it is suggested that a member of the Advanced First Aid team should be assigned to each lifeboat. In addition to providing First Aid this individual would be able to recognize and prevent the hazards to survival discussed above. It is also suggested that all personnel should be trained in First Aid. In addition to instruction in the treatment of near-drowning victims and the prophylaxis and First Aid of hypothermia victims, the training should include instruction in the prophylaxis of motion sickness.

## 7.8 SUMMARY

1. The location, size and services of the sickbay should be considered in the design of a drilling unit in consultation with physicians and experts in hospital design.

2. The location of the sickbay is determined by access to and from the work area and the landing area, freedom from noise and availability of an adjacent large area for triage of mass casualties.

3. The U.K. standards for size of the sickbay were cited.

4. Services in the sickbay should include good sound insulation, adequate storage, sink and toilet, work surfaces, ventilation and temperature control and disposal facilities. Medications should be kept in a secure, locked cupboard.

5. Communication should be available from the sickbay to other parts of the installation and to onshore bases.

6. Regulatory agencies should specify the minimum standards for medical equipment and supplies to be held offshore.
7. X-ray machines are not suggested as standard pieces of equipment. An ECG and a defibrillator may be provided if the medic is trained to a level to use them appropriately.

8. The stocks of medical equipment to be carried should be related to the anticipated numbers and types of patients or casualties. These figures are difficult to estimate.

9. In addition to medical supplies, items such as blankets, sheets, pillows, etc., should be available to use in emergencies.

10. The required characteristics of the general purpose rescue stretcher were reviewed.

11. The features of the following specialized stretchers were reviewed:

    a) The Neil-Robertson Stretcher - useful for manoeuvring a patient from heights but does not have a rigid frame.

    b) The Paraguard Stretcher, which has rigidity, is easily transported and can be winched. Training is required in packing and assembly.

    c) The Orthopaedic Scoop Stretcher can avoid injuries due to lifting a patient but is not stable for use in transporting a patient over long distances.

It is suggested that on an offshore installation there should be 10 rescue stretchers, (based on 85 crew members), one Neil-Robertson or Paraguard and one Orthopaedic Scoop.

12. The major problems of survival are hypothermia, thirst, motion sickness, exhaustion, heat stroke and hunger. Morale has significant effect on the outcome.

13. Current scales of provisions on lifeboats appear to be satisfactory.

14. The hazards involved in abandoning an installation include:

    a) trauma from falls and impact

    b) hypothermia from immersion or from exposure to wet and cold conditions

c) <u>frostbite and trench foot</u>

d) <u>motion sickness</u> - a more severe problem than is usually recognized. Prophylactic agents are listed and discussed.

15. Personnel should be trained to use lifeboats and liferafts. An advanced First Aid worker should be assigned to each lifeboat. All workers should have First Aid training for use in an emergency.

16. The contents of the medical kit as required by the Canada Shipping Act Regulations were listed and discussed. Agents for treating seasickness, antiseptic cream, petroleum jelly and a general purpose antibiotic are suggested additions.

17. The dosages should now be expressed under the metric system.

## REFERENCES

1. Brebner, John,; Personal Communication, August, 1983.

2. Cox, R.A.F.; "Offshore Medicine, Medical Care of Employees in the Offshore Oil Industry", Springer-Verlag, New York, pp. 58-64.

3. Information from Professor J. Nelson Norman, Senior Consultant, August, 1983.

4. Cross, J.H., Feather, J.M.; "The Safe Evacuation of Men During Emergency Abandonment of Offshore Oil and Gas Installations - Survival While Awaiting Rescue", EEC Symposium on Occupational Health and Safety of Workers in the Petroleum Extractive Industry, held in Luxembourg, April 19-20, 1983, pp. 234-248.

5. Manson, H.; "Hypothermia", Related Papers for the Occupational Health and Safety Study, Centre for Offshore and Remote Medicine, Memorial University of Newfondland, 1983.

6. Colohan, D.; "Emergency Medical Response to the Offshore Environment", Centre for Offshore and Remote Medicine, Memorial Univerity of Newfoundland, 1983.

7. Cox, pp. 149-152.

Chapter 8

# A REVIEW OF OFFSHORE HEALTH PERSONNEL DUTIES, QUALIFICATIONS AND CONTINUING MEDICAL EDUCATION

## 8.1 INTRODUCTION

As a general principle, the standards of health care to be provided for workers offshore should be as high as those which are applied to workers in onshore industries. Thus, health personnel who work in the offshore oil industry should possess the basic education, skills and experience that would be expected in a similar industry onshore. In addition, the physician, nurse or armed forces medic must learn about the unique medical problems which can arise and the many factors which have an impact on the function and health of offshore workers.

## 8.2 A REVIEW OF THE RIG MEDIC POSITION

The rig medic is usually the most highly skilled health care provider on an offshore drilling unit. He is responsible for treating patients autonomously with minor illness and injuries. In the event of a serious injury or illness, he consults with the shore-based company physician and administers treatment in accordance with the physician's orders. In essence, the medic may work in lieu of a physician or as an extension of the shore-based company physician.

The medic also plays a crucial role in medical emergencies and, in consultation with the onshore physician, is responsible for initiating the critical life saving measures. For a serious injury involving bleeding and respiratory problems treatment must be instituted within two hours, as a longer delay makes it more difficult to stabilize the patient and may have fatal consequences.

In such an emergency the medic should be assisted by a competent first aid team trained to an advanced level of first aid. These specially trained workers should also be able to function as escorts for any patient who has to be evacuated for treatment onshore, as the medic is not permitted to leave the rig. The training and composition of the advanced first aid team is discussed in Chapter 9.

On the Canadian East Coast, the remoteness and isolation of the offshore drilling operations mean that the medic may be required to care for a seriously injured or ill individual for up to several days should weather conditions prevent evacuation to onshore medical facilities. The rig medic should be qualified to provide routine care for minor health matters and, in consultation, to initiate emergency procedures and, on occasions

to carry out extended care.

With this background, the medical and non-medical duties of the rig medic and the established minimum qualifications of rig medics in the USA, UK, Norway and Canada will be reviewed.

## 8.2.1 MEDICAL DUTIES OF THE RIG MEDIC

The rig medic's duties may vary depending on company policy but in general range from conducting a routine sick parade to handling multiple casualties. They may include:

i. Administering advanced first aid, including care for severe trauma and illness.

ii. Taking a medical history and performing a physical examination for a wide range of problems including trauma and acute medical conditions.

iii. Communicating the findings to the shore-based company physician as appropriate and carrying out the required procedures.

iv. Stabilizing patients for transportation and performing diagnostic and therapeutic manoeuvres under the directions of the shore-based physician.

v. Providing care for patients, including seriously ill or injured patients, for extended periods when transportation is not feasible. This would again be under the shore-based physician's direction.

vi. Advising the platform manager, or the ship's master on medical matters.

vii. Advising the diving supervisor and diver/medical technician on medical matters. Assisting in the medical care of sick or injured divers.

viii. Advising the installation manager, toolpusher, or marine master on public health matters (food handling, hygiene, water quality, sound levels, pollution, toxic substances). Inspecting and enforcing regulations/company policy in these matters.

ix. Diagnosing and treating minor ailments. Prescribing and dispensing a wide range of medications, with or without physician advice.

x. Diagnosing and treating psychiatric ill health and social problems, the management of drug and alcohol related problems and conducting counselling on personal problems.

xi. Triage of casualties. Handling mass casualties. Advising the installation manager or vessel's master of the necessity for medical evacuation.

xii. Maintaining the sick bay and the inventory and records of medical supplies, drugs and equipment.

xiii. Leading and continuing to train and exercise an Advanced First Aid Team who can provide assistance in emergencies and can be allocated to individual lifeboats to offer first aid if the installation is to be evacuated. Further discussion of the advanced first aid team is presented in section 9.3.

8.2.2 REQUISITE MEDICAL SKILLS AND KNOWLEDGE OF THE RIG MEDIC

From the above list of duties, the skills and knowledge which the medic requires can be identified and be categorized as follows:

i. Basic knowledge of anatomy, physiology, pharmacology and pathology. In some areas a broad knowledge is required but in others, detailed or indepth knowledge is necessary. For example, considerable knowledge of the anatomy of the hand will be necessary as prior experience indicates the medic may expect to have to treat a number of hand injuries (Refer to section 6.7.5 "Part of Body Injured on All Drill Units and Standby/Supply Vessels").

ii. Thorough competence in the basic skills of history-taking and physical examination of all body systems, to enable the medic to act adequately as the ears, eyes and hands of the remote physician, who must make the ultimate diagnosis and prescribe the treatment.

The majority of the medic's patients present the routine problems which a general medical practitioner sees daily in his office. Therefore, skill in acute casualty management must be supported by a wider competence in patient assessment.

Several specialized areas of competence are also necessary. For example, examination of the eye is often required as a foreign body in the eye is a very common injury on a drilling unit (Refer to section 6.7.5 "Part of Body Injured on All Drill Units and Standby Vessels"). Examination of the ear is required if the medic will be assisting in the care of divers.

iii. From basic knowledge and skills in examination, the medic should be able to reach a diagnosis and to communicate his findings in a rational, problem-oriented manner which will lead to successful management of a broad range of

problems.

iv. Practice is required to communicate findings effectively to a remote physician, and to understand and act upon his instructions.

v. A broad working knowledge of pharmacology is needed, including the initial dosage and effects of each drug, the cumulative effect of drugs given over a period of time; drug-interactions. For example, if an individual is given a sedative at night, will he be safe to work the next day, or will he be impaired by "hangover" effects?

vi. The medic must be trained in the resuscitation of the seriously ill or injured casualty.

a. The minimum level of competence required would be the Basic Cardiac Life Support standard of the Canadian Heart Association, but Advanced Cardiac Life Support training would be an advantage.

b. In addition, the medic must be skilled in management of the airway, including manual techniques, the use of oropharyngeal airways, endotracheal intubation, and the use of oesophageal obturator airways, and cricothyrotomy.

c. The medic must have a thorough knowledge of the equipment used for oxygen administration and its effects, and should also be familiar with the use of manual and automatic lung ventilation equipment with a basic understanding of the indications for and effects of its use.

d. He must know how to control haemorrhage and how to detect the onset of shock, with an indepth knowledge of the principles and practice of intravenous fluid therapy. Correct usage of Military Antishock Trousers (MAST) is another essential skill.

e. Skill in assessing and monitoring head injuries and knowledge of their correct management is required.

f. In addition to dealing with trauma, knowledge of the acute care and resuscitation of common medical and surgical illness is needed. In a properly screened population the use of such skills should be rare, but there is always the possibility of events such as myocardial infarction, haemorrhage or perforation of a peptic ulcer.

vii. The medic must thoroughly understand the pathophysiology of

drowning and hypothermia and have detailed knowledge of their management.

viii. The medic must understand the concepts of public health and industrial hygiene and the control of infectious diseases. The knowledge required includes an understanding of the relevant regulations and standards and of inspection methods, immunization techniques, and of the principles of bacteriology.

ix. Some surgical skills are required. While the medic will not be attempting major surgery, he should be skilled in the control of haemorrhage, suturing and the cleaning, debridement, dressing and management of wounds, with a thoroughly understanding of aseptic techniques.

x. While it is not anticipated that the medic will manage diving illnesses, he should be able to communicate knowledgably between the diving team and a shore based physician and to advise the diving supervisor intelligently. This means that he must know the principles of hyperbaric medicine and physiology and have a knowledge of drug interactions in the hyperbaric environment.

xi. Counselling skills and psychiatric knowledge are among the most important areas of competence for the medic for he will be expected to offer advice and assist in the management of personal and family problems, and to deal with acute psychiatric emergencies.

The broad and indepth medical knowledge and skills as outlined above are required in order for the medic to perform his duties adequately. The descriptions of these duties provide a background for the subsequent discussion of the education and training required by a medic.

### 8.2.3 NON-MEDICAL DUTIES OF THE RIG MEDIC

It is a worldwide practice in the oil industry to assign non-medical duties to the medic, since his daily activities leave a significant amount of free time. The average daily consultation rate on an oil rig in the North Sea is seven patient visits per one hundred men per day(1). This is similar to other statistics from the Scandinavian and British offshore oil industries. On one rig operating on the Canadian East Coast the medic reported an average of 6 consultations per day (Refer to Chapter 6, Part II, Table 1).

While it is desirable that the medic's day be fully occupied to help prevent excessive boredom, his medical duties must always assume priority over any other secondary duty which is assigned(2,3). It is also essential that in an emergency, the

medic's secondary role should not conflict with his medical role. Similar conflicts must be avoided in the emergency duties assigned to members of the advanced first aid team who will assist the medic.

The secondary non-medical roles typically assigned to the medic, the skills they require and the potential for conflict with the medic's emergency medical duties are outlined:

a. Helicopter dispatch officer

The helicopter dispatch officer receives and dispatches all crew members. This duty provides the medic with the opportunity to meet and become familiar with all the members of the crew. The required skills are basically clerical and record-keeping with typing an advantage. These duties could easily be suspended in an emergency.

b. Radio operator (relief)

The radio operator maintains a radio-telephone watch, sends radio-telephone messages and may act as a telex operator. The minimum required qualification is a radio-telephone operator's certificate. While the medic may act as a relief operator under normal conditions, this role could conflict with the medic's emergency medical role.

The radio operator's role is vitally important to the successful management of an emergency. In addition to the assigned radio operator, it is essential to have a trained person other than the medic available to operate the radio equipment at all times. As a maxim, the medic should only assume the radio operator's role on a temporary relief basis.

c. Safety officer

The safety officer conducts crew orientation (with or without assistance from the marine officers). He ensures that safety gear is worn and used, and that all operations are conducted in a safe manner. He also monitors dangerous substances and procedures. He is involved in training the fire fighting and first aid teams and provides $H_2S$ training. The requisite skills are extensive knowledge of the installation and of the work performed, training in safety procedures and training to the instructor level in $H_2S$. This position requires leadership qualities. This role may conflict with the medic's need to maintain patient confidentiality and the patient/medic relationship.

## 8.2.4 PATIENT/MEDIC RELATIONSHIP: CONFLICTS ARISING FROM THE ORGANIZATIONAL STRUCTURE AND HIRING PRACTICES

In the medical profession it is of great importance to maintain the patient's trust and confidence in the physician. Medical records are maintained as private and confidential and are not divulged without the specific consent of the patient. In a normal patient/physician relationship, the physician is responsible only to the patient. The physician who is retained by a company is also obliged to respond to the requirements of management for information regarding a person's fitness to work. This obligation conflicts with the traditional confidentiality and privilege of the patient/physician relationship.

A similar conflict can occur for the rig medic who may be an employee of the operating company, the drilling company, or in some instances the subcontractors supplying medical or personnel services to the drilling operation. As an employee of management whose interests frequently do not coincide with those of the workers the medic may encounter situations which threaten to jeopardize the confidentiality of the patient/medic relationship. In these situations, the medic's dual responsibility to his employer and to his patient causes a conflict similar to those in the relationship between patient and occupational physician described above.

The medic may also be put in conflict in his relationship with a patient by parties other than the employer. For example, the medic who is employed by a drilling company is directly answerable to the drilling company, and is responsible to the company physician for professional matters. However he is also responsible to the drilling unit manager or the toolpusher for administrative matters. This situation is further complicated when the medic has to deal with patients employed by a number of contractors and subcontractors as well as by the operating company. The medic/patient confidence may be threatened by mixed and conflicting loyalties arising from the contractual relationship.

If an employee discloses a medical problem which casts doubt on his fitness for employment, or entails a danger to himself and others, the medic's duty is clearly to counsel the employee to resign. If the employee refuses to resign, the medic must report the matter to the employer who may terminate the employment. Often such matters are not clear cut and consequently judgment must be exercised.

The confidence of the patient may also be breached through the medical records. The medical profession contends that these records should be treated as confidential between the patient, medic and company physician. However, in oil and drilling companies medical records are often available to, or kept by,

management, usually the personnel department. There is then the danger that a recorded adverse medical history may lead to a decision by management that could jeopardize the employee's job or future promotion opportunities.

The medic must resolve the problems arising from his role as a health care provider and from responsibility to his company in such a way as to continue to enjoy the confidence of all parties, particularly those under his care. To deal with such conflicts of role and responsibility the medic must possess maturity of judgement and good interpersonal skills. These characteristics are acquired only by experience and are not easily assessed.

This need for maturity of judgment, as well as the technical requirements of broad experience in the practical management of medical problems, may make newly qualified physicians less suitable for the post of rig medic than experienced nurses or TQ6Bs.

## 8.1.5 RIG MEDIC QUALIFICATIONS IN THE U.S.A., U.K., NORWAY AND CANADA

In the light of the above, the selection of rig medics requires attention to the duties to be performed and the skills and knowledge required. The following comparisons indicate that hiring practices in different areas of the world have varied over time.

a. United States

In the southern USA, the qualifications of rig medics vary from company to company. The most common categories of personnel hired as medics are ex-military medics, so-called "paramedics" or emergency medical technicians (who will have undertaken training programs of varying length, up to two years) and persons with first aid qualifications(4). There are indications that these qualifications are satisfactory for medics on the drilling units operating in the Gulf of Mexico due to the proximity of the units to shore and the usually favourable weather conditions which allow helicopter transport on a regular basis.

b. United Kingdom

Formerly, in the Southern sector of the North Sea, military medics or persons with first aid qualifications were employed as medics. However, the current trend has been to employ only ex-military medics of the MA-1 qualification which a military medical assistant requires for independent duty, (equivalent to the Canadian Armed Forces TQ6B) or persons with nursing qualifications, such as State Registered Nurses (SRN's, equivalent to Canadian RN qualifications)(8). Some State Enrolled Nurses (SEN, equivalent to a Canadian Nursing

Aide) have been employed but they were considered to be insufficiently trained to perform the duties assigned to the medic. Legislation is being enacted which allows only ex-military MA1's or SRN's to be employed as offshore medics(9).

c. NORWAY

In Norway, only state registered nurses are acceptable for offshore medic positions(10,11). A significant number of the nurses employed in the Norwegian sector of the North Sea received additional training as nurse anaesthetists which is considered to be a very satisfactory background. There is no Canadian equivalent to a nurse anaesthetist.

d. Canada

At present, in Canada, retired Canadian military TQ6A and TQ6B medics, Registered Nurses, US Armed Forces military technicians and emergency medical technicians are employed as rig medics on offshore drilling operations. In fact, current federal and provincial regulations would allow a provincially certified First Aid person to be hired as a rig medic(5,7). There is, however, also a Federal guideline which requires that the rig medic be able to perform a number of specific functions (set up an IV, etc.) which are beyond the skills of such a person(6). This conflict within official regulations and guidelines illustrates the need for expert medical input into such regulations.

Canadian law does not allow sexual discrimination in hiring personnel with the result that females are often employed as rig medics. The Norwegian system also promotes the employment of females as rig medics. There is no evidence that this practice has proven unsatisfactory anywhere in the world and the consensus is that the female medics employed on drilling units on the Canadian East Coast have performed satisfactorily.

## 8.3 EDUCATION AND TRAINING OF RIG MEDICS AND PHYSICIANS IN CANADA

Qualifications such as an RN, a TQ6B (armed forces) or a medical degree do not by themselves prepare these health workers to provide quality care, but represent only minimum requirements. Education and training programs should be available to provide all prospective offshore physicians and medics with the information and practical training needed to perform duties required of them in providing health care to offshore workers.

### 8.3.1 TQ6B EX-MILITARY MEDIC

Of the categories of personnel hired as rig medics in the Canadian East Coast, perhaps the independent-duty ex-military TQ6B medic is

the person best suited by background for training as a rig medic, especially those with naval backgrounds. In addition to sea experience, naval TQ6B's tend to have had more independent duty experiences than other categories of Canadian military medics. Appendix 8-A outlines the level and area of training of the TQ6A and B. It is desirable that all TQ6B medics have additional education and training in advanced techniques of resuscitation and airway management, psychiatry, public health, industrial hygiene, diving medicine, hypothermia and exposure, and community health. This education can be provided in one to six months depending on the individual's background. Curricula based on a modular system should be developed in one or more health educational institutions to prepare this group to function at the required level.

Unfortunately, an ex-military medic in Canada has no legal status as a health professional, is not recognized in any province and hence has no professional/disciplinary body to which he can relate. In consequence, medical legal hazards exist for the medic, the employer and the supervising physician. (Refer to Chapter 2 Section 2.4 Registration and Licence). Further the armed forces medics will have difficulty in moving from the offshore to land-based positions. This will not present a major problem because individuals with the qualification of TQ6B will be of an age which will, in all likelihood, see them working offshore for not more than several years. With their armed forces training these medics will be qualified to provide emergency care, cardiac life support techniques and training in the transfer of patients. Because these individuals in peace time have little experience, these skills will need upgrading.

## 8.3.2 REGISTERED NURSES

Registered Nurses have the most depth and breadth of medical knowledge within the groups considered. They are legally recognized as health care professionals under provincial laws and are required to be duly registered and licensed with a provincial nursing association through their period of employment in a nursing capacity. Their relations with patients and physicians are regulated by legislation and by long tradition.

However, the work experience of the individual registered nurse is a major factor in determining his suitability for the position of a rig medic on a remote offshore drilling unit. Newly qualified nurses do not have the experience or the training in many of the areas outlined in the "Medical Duties of the Rig Medic" Section 8.1.1. Similarly, specialization in psychiatry, geriatrics, paediatrics, obstetrics and other areas provide insufficient breadth of experience to allow the nurse to perform effectively the duties of the rig medic. For example, a nurse who has worked solely in the area of psychiatry will not have the requisite surgical knowledge needed by the medic.

Postgraduate experience in emergency medicine, intensive care, general surgery or general medicine would be a desirable background for the prospective nurse/medic.

Nurses who have completed the Outpost Nursing Program such as that being offered by Memorial University School of Nursing and Dalhousie Faculty of Health Sciences will require only a few weeks additional training and orientation to bring them to an optimum level for the role of nurse/medic. The curriculum of the Outpost Nursing course is presented in Appendix 8-B.

The outpost nurse would bring a broad background of training and experience to the position and would be able to move from the offshore to jobs in remote sites onshore or emergency departments or external care units for periods of time. This is important because the nature of the work and the variation in demand for offshore health personnel will probably result in the offshore nurse medic being a temporary career choice (perhaps up to several years) rather than being a lifelong career. When not working offshore these well trained individuals could fill a variety of positions onshore in service, education and occupational health units in industry.

The nurse with the basic R.N. qualification is suitable for employment as a rig medic, after taking further training. To allow for the needs of individuals, the training course could be based on a number of specialized modules, each of between two to eight weeks' duration. A registered nurse with none of the education and skills appropriate for the offshore will require to take all the modules over a period of approximately six months of training. Any relevant experience will obviously shorten this training period.

### 8.3.3 EMERGENCY MEDICAL TECHNICIANS

At present, emergency medical technicians (EMT) are also permitted to serve as medics for Canadian East Coast drilling operations. A review of several EMT training courses indicated that the courses concentrate on the emergency care (stabilization) of acute conditions and rapid transport of the patient to the hospital. However, the medical duties of the medic require a much broader knowledge base than life support techniques. These paramedics or emergency medical technicians have only limited pharmacological knowledge (ACLS drugs, sedative and anti-epileptic drugs). They have no experience of diagnosing or treating minor ailments which typically account for a high percentage of the medic's consultations in the offshore environment. Furthermore, their assessment skills (history taking, physical examination and diagnosis) are narrowly oriented towards that necessary for life support. They have limited psychiatric counselling training. They do not have public health or industrial hygiene training, or the knowledge on which these specialities are based.

Overall, the EMT does not have an adequate knowledge of the basic sciences as compared to the training of TQ6B military medics and registered nurses. In addition, they do not have the broad work experience which is the major strength of the TQ6B military medic.

Paramedics can obtain registration in British Columbia and Alberta, however, this registration is not transferable to other provinces. It is suggested that EMTs require basic and advanced training beyond the available University sponsored rig medic refresher courses before they are qualified to assume the rig medic position.

8.3.4. PHYSICIANS

Physicians who have no formal training or experience in emergency care will require special training in emergency medicine including basic life support techniques, the management and treatment of cardiac arrest, near-drowning and hypothermia. Although they are not expected to be experts in diving medicine, they should have sufficient basic knowledge of the medical hazards and problems associated with diving to recognize complications, to offer appropriate immediate advice and assistance and to obtain expert help at short notice.

As they may have to proceed offshore, physicians should be familiar with the work place, the nature of the operations on the installation and the layout, equipment and supplies of the sick bay. They should know the procedures involved in transferring a patient from a rig or standby vessel to another vessel or helicopter and should expect that they themselves will have to be transferred by these means.

A physician who has none of these skills or experience will require a training course of about 80 hours' duration before being considered to be competent to assume full responsibility as an offshore physician.

## 8.4 CONTINUING MEDICAL EDUCATION

Health workers offshore are called on infrequently to provide care, consequently, their skills and performance can quickly deteriorate. Thus it should be mandatory for these individuals to participate regularly in continuing education courses, including "hands on" experience in clinics, hospitals and emergency departments.

The amount of continuing education required by health workers in general has been arrived at arbitrarily without a scientific basis. The same approach has to be taken with offshore health workers and at best a reasonable suggestion can be made.

To maintain their skills, physicians should probably spend

approximately 50 hours every three years attending recognized short courses and other CME sessions directed to offshore medicine. Company medical directors and company physicians should spend at least a full day on an offshore rig each year.

The provision of practical continuing education for nurses will not be a problem. However, such is not the case with the armed forces trained personnel who have no status in the health system. Special attention will have to be paid to this problem.

Medics should have CME refresher courses of approximately 40 hours per year or about 100 hours every three years. A refresher course such as that recently begun at Memorial University is an example of one such course (Refer to Appendix 8-C). Because of relatively small numbers of medics working at present it would be desirable for two or more universities to provide joint courses in different parts of the country once or twice a year to facilitate attendance and to reduce costs wherever possible.

Medics should participate actively with course organizers when content is being planned. There should also be substantial involvement of medical directors and other industry physicians both in the planning and teaching of these courses.

Education and training should be a priority matter for discussion by the regulatory agencies, educators, and health and safety representatives of industry. The establishment of common ground between those groups will facilitate coordination, reduce fragmentation and redundancy, and improve effectiveness and efficiency of the developing Canadian offshore health education program.

## 8.5 SUMMARY

1. The rig medic may work in lieu of a physician or as an extension of the shore-based company doctor.

2. The medic has a crucial role in dealing with medical emergencies on an immediate basis and over a long period, and should be supported by a competent first aid team.

3. The medical duties of the rig medic were listed ranging from maintaining records to handling mass casualties.

4. The skills required by the medic to carry out his medical duties were listed and involve a wide range from public health inspection to carrying out minor surgical procedures.

5. The rig medic may have non-medical duties such as helicopter dispatch officer, radio operator and safety officer. These duties should not conflict with his medical duties in an

emergency.

6. The patient/medic relationship is analogous to the doctor/patient relationship. This can be compromised by conflicts between loyalty to the patient and responsibility to the employing agency or several agencies. Some maturity of judgement is required by the rig medic to deal with these conflicts.

7. The qualifications of rig medics in the U.S., U.K. and Norway were reviewed. In Canada, rig medics may be registered nurses, emergency medical technicians or ex-military medics. The ex-military medic has, at present, no legal status in the health care system.

8. Ex-military medics, registered nurses and emergency medical technicians have been employed as rig medics. Of these, the emergency medical technician is least suitable by training for this role.

9. The status of the nurse in the health system is recognized but the status of the ex-military medic will have to be determined.

10. All medical offshore personnel will require some degree of training before being able to provide health care offshore. For physicians, some 80 hours of instruction would be required and a six-month course would be required by medics. This period of time would be reduced by instituting a modular course in which the training could be tailored to the needs of the individual nurse or ex-military medic.

11. After this initial training, some 50 hours of Continuing Medical Education would be required over three years for physicians. For medics, 100 hours over three years would be required.

12. These training and continuing medical education courses could be conducted jointly by educational institutions.

13. Basic First Aid training is advocated for all workers offshore, the standards and levels of training being set by the regulatory agencies. Special features such as CPR, $H_2S$ poisoning, drowning and hypothermia should be emphasized and refresher courses should be held regularly.

14. A team of Advanced First Aid workers, numbering about 10% of the complement, should be trained to act as support to the medic in an emergency and to serve as escorts for patients being evacuated.

15. The medic should be responsible for forming and training this

Advanced First Aid team and for arranging exercises to maintain its level of competence. Annual refresher courses should be held.

## 8.6 CONCLUSIONS

The Registered Nurse and the Canadian military TQ6B medic are highly suitable for employment as rig medics based upon the assessment of the requisite training for these qualifications. The emergency medical technicians training is considered to provide an inadequate background for the performance of the offshore rig medic's duties.

A mechanism should be found to allow regularization of the position of ex-military medics (TQ6B). This may be achieved through the Canadian Medical Association Allied Health Professional Programme.

Both the registered nurses and the TQ6B military medics may require additional training in advanced techniques of resuscitation and airway management, psychiatry, public health and industrial hygiene, and hyperbaric medicine. For medics, a six-month course would be required, but this could be shortened considerably by devising a series of training modules which could be offered dependent upon the education, training and expertise of the individual RN or forces trained medic. Outpost nurses would require a minimum of training. Given this basic initial training, offshore health workers should be required to update their knowledge and skills by attending continuing education courses. It is suggested that over a period of three years, medics require approximately three weeks of continuing medical education. The status of Canadian armed forces medics attending such courses will have to be established.

Physicians practicing in the offshore should have a significant knowledge of emergency medicine including basic life support, management and treatment of cardiac arrest, near-drowning and hypothermia. In addition they should have a basic knowledge of diving medicine. The physician should be thoroughly familiar with the offshore work and living environment and the sickbays' facilities, supplies and equipment, and winching procedures.

It is suggested that in a three year period physicians would require 50 hours of continuing medical education.

Training and continuing education programs can be run jointly by two or more universities.

## REFERENCES


1. Anderson, I.K.; "Rig Mash", Unpublished paper presented by North Sea Medical Centre Limited, p. 49.

2. Ibid, p. 43.

3. "Provisional Standard Directives for State Registered Nurses Employed on Installations for production etc. in petroleum activities on the Continental Shelf", Ministry of Social Affairs, The Continental Shelf, Norwegian Petroleum Directorate, 1.1.83, p. 225.

4. Personnel Correspondence with Dr. Gordon Daugherty, March 7, 1983.

5. Canada Oil and Gas Drilling Regulations (Office Consolidation), Canada Oil and Gas Lands Administration, Ottawa, November 1980, section 35 (5) (c), p. 13.

6. "Drilling for Oil and Gas on Canada Lands, Procedures and Guidelines", Canada Oil and Gas Lands Administration, May 1982, Appendix J(c).

7. Newfoundland and Labrador Petroleum Drilling Regulations, Newfoundland and Labrador Petroleum Directorate, 1982, section 187 (5) (c), p. 99.

8. Norman, J.N.; "Second Interim Report for the Occupational Health and Safety Study: Training", April 1983.

9. Meeting of Study Team with J. Nelson Norman, St. John's, August 1983.

10. Sunde, Arne; "Report Following a Visit to the Centre for Offshore and Remote Medicine, Memorial University of Newfoundland", July 2-8, 1983 p. 3.

11. "Provisional Standard Directives for State Registered Nurses Employed on Installations for Production etc. in the Petroleum Activities on the Continental Shelf", The Royal Ministry of Social Affairs, May 8, 1977, The Continental Shelf, Norwegian Petroleum Directorate, 1.1.83, pp. 225-226.

Chapter 9

# FIRST AID TRAINING FOR OFFSHORE WORKERS

## 9.1 INTRODUCTION

It is a well established principle of emergency medicine that events occurring during the two hours immediately following trauma or sudden onset of illness have a major effect upon the outcome. For equivalent injuries or acute illnesses, the outcome has been observed to be less favourable in remote rural settings than in urban settings where there is greater availability of immediate medical attention.

Although the majority of offshore workers are young and their health has been assessed by pre-employment medicals, there will inevitably be incidents of acute medical illness, which require treatment and care in this critical period. A pre-employment medical examination may not be a good predictor of some cases of acute myocardial infarction which commonly leads to the acute onset of an abnormal heart rhythm which can trigger a cardiac arrest which may be fatal if cardiopulmonary resuscitation is not performed. This dramatic illustration of the need for immediately available first aid was selected because coronary artery disease is an extremely common condition and acute myocardial infarction is one of the commonest causes of death in the age group 40 to 50 years.

There are several other conditions in which the intervention of first aid may significantly affect the outcome of injury.

i) A major haemorrhage may be life threatening unless procedures used to control haemorrhage are initiated

ii) A traumatized unconscious victim is immediately at risk of asphyxiation due to the victim's tongue falling back and occluding his airway, or by inhalation of vomitus

iii) An injury to a limb may be complicated by ill-advised handling or movement of the victim which can result in damage to the nerve or blood supply to the limb. Furthermore if an individual with a spinal cord injury is moved inexpertly it may result in permanent paralysis.

iv) Electrocution, near drowning and hydrogen sulphide gas poisoning commonly lead to respiratory and cardiac arrest. To resuscitate the victim, mouth to mouth artificial ventilation and cardiac massage must be administered within four minutes to prevent irreparable damage.

Hydrogen sulphide gas is present in several locations on the

Canadian East Coast and there are indications it is a greater hazard on an offshore rig than a land rig. At present, offshore workers are only trained to recognize the effects of hydrogen sulphide, but, it is suggested that they should be trained to perform cardipulmonary resuscitation.

## 9.2 BASIC FIRST AID TRAINING FOR ALL WORKERS

Although a significant percentage of the procedures taught in first aid courses are not life saving measures such as those listed above, universal first aid training would ensure that medical attention could be delivered to the patient by the first persons on the scene at an accident during evacuation.

This aspect of first response to a medical problem makes it highly desirable that all the workers in the offshore petroleum drilling industry, receive training in first aid. Currently, the safety and medical representatives of the Canadian petroleum operators assert that only a certain proportion of workers need to be trained in first aid(1), claiming that if 50% of offshore workers are trained in first aid there is a low probability that a group in a lifeboat will not include a first aider. However, on this basis there is only a 50% chance that of two men in a liferaft one will be a first aider. Similarly, the chances that an appropriately trained colleague will be working in close proximity to a man who is electrocuted or overcome by $H_2S$ will be significantly reduced. Apart from the advantages of providing first response to a casualty, universal first aid training fosters 'self-help' and an appreciation of the measures being taken on their behalf. All regular offshore workers in the Norwegian sector and the majority of workers in the UK sector of the North Sea receive first aid training and there are indications that such training is advocated by the medical departments of the major oil companies active in the North Sea(2). The U.K. Health and Safety Executive has issued a recommended standard of first aid training(3).

At present workers entering the offshore work force in Newfoundland are required by the Newfoundland Petroleum Directorate to take the College of Fisheries, Marine Emergency Duties course, which contains some basic first aid training(4). There are indications that the current Marine Emergency Duty course may be superseded by training programs developed specifically for the offshore oil worker(5). In these new programs the level of first aid training for all offshore workers should be specified.

### 9.2.1 LEVEL OF TRAINING

The first aid training courses given by the St. John Ambulance Association and the Canadian Red Cross are nationally recognized. Although these courses may provide a basic framework, they are not

fully tailored to meet the needs of the offshore work force. Many first aid courses continue to teach obsolete procedures such as manual methods of artificial respiration. The content of first aid courses should be developed and periodically reviewed by physicians with appropriate experience, in order to ensure that they are medically accurate, up to date and relevant for the offshore.

Since the levels of safety required on the Canadian East Coast offshore oil industry are usually set by government regulatory agencies, it is suggested that these agencies should assume responsibility for:

i) approving the course content,

ii) monitoring the adequacy and efficiency of examination procedures of safety courses designed for offshore workers, and

iii) certifying that persons or institutions offering such training are adequately trained and equipped to conduct the course as outlined.

9.2.2 SUGGESTED CONTENT FOR OFFSHORE FIRST AID COURSES

An adequate first aid course for offshore workers should include training in basic safety-oriented first aid, cardiopulmonary resuscitation, and hydrogen sulphide poisoning. The cardiopulmonary resuscitation courses offered by the Canadian Heart Association and the hydrogen sulphide courses, approved by the Petroleum Industry Training Services are recommended.

Since the worksite is located offshore, training modules dealing with drowning and hypothermia should be more extensive than those offered in standard first aid courses.

To reduce training time and costs, sections of standard first aid courses such as obstetrics and paediatrics should be omitted as pregnancy is normally a contraindication to employment offshore (Refer to section 3.4.8) and the minimum age for offshore workers established by provincial legislation is eighteen. Unfortunately, omitting these sections prevents certification of the courses under any of the existing programs of the Canadian Red Cross or St. John Ambulance Association. To circumvent this problem the first aid courses developed for offshore workers could be certified by the regulatory agencies . An outline of the content of such a course and the suggested time allotted to various modules is presented in Appendix 9-A.

It is not vital that visitors to an offshore installation and those who are required to work on an MODU only occasionally should undertake this training, since they should be under the supervision and care of some regular member of the offshore work-force during their visit offshore.

### 9.2.3 REFRESHER COURSES

To avoid decline in or loss of skills, first aid training should be updated regularly either by:-

i) repeating the complete course at regular intervals, such as every three years as is the current practice with the Marine Emergency Duties course, or

ii) dividing the course into separate modules which can be given on a one day per year basis in order to maintain certification. This alternative is advantageous from the point of view of learning theory, but might present administrative problems such as maintaining records of each person's training, and requiring frequent logistical changes.

### 9.3 **THE ADVANCED FIRST AID TEAM**

In addition to requiring basic first aid training for all workers, a team of workers on each offshore unit should be trained in advanced first aid for the following reasons:

i) There would be a pool of crew members who could substitute to provide care if the medic were incapacitated. If the work force is being evacuated from the MODU by the lifeboats, a crew member trained in advanced first aid could be assigned to each lifeboat in order to provide widespread first aid coverage for the crew.

ii) An advanced first aid team can provide assistance to the medic in several situations(6):

   a) where there are multiple casualties and one medic alone cannot attend to all of them simultaneously,

   b) where there is a single injured casualty with multiple trauma and haemorrhage and airway obstruction problems. This situation actually occurred on the Nova Scotian Shelf, or

   c) where a seriously ill or injured patient is being transported ashore the rig medic should not be permitted to leave the MODU. In such situations an advanced first aider may act as escort to the patient in case of deterioration in his condition, such as the onset of unconsciousness and airway obstruction.

It is suggested that there be a requirement to form and train an advanced first aid team on each mobile drilling unit or installation, to include at least 10% of the unit's complement. A minimum number of four trained persons on each crew change, in addition to the medic, would be required to cope with situations

involving multiple trauma where there may be a need for two persons to administer CPR while others control haemorrhage, establish intravenous infusions, or assist in carrying out the procedures specified by the onshore physician.

Furthermore, this minimum of four would ensure that if one or more of the advanced first aid team were required to escort patients being evacuated , the MODU or installation would not be left without effective support for the medic.

To act as escorts, two members of the team could be trained to the Canadian Medical Association (CMA) Emergency Medical Attendants standards, which are becoming nationally recognized as appropriate for ambulance attendants. These standards, which are presented in Appendix 9-B have three levels. Of these, Level II standard is most suitable for the offshore medical escort, but a Level I standard would be considered to be an improvement over the present situation. Unfortunately, some material in these courses is not relevant to the offshore scene but by following a national standard, the problems of recognition of qualifications and consequent medicolegal difficulties can be avoided.

As indicated previously, crew members chosen for the advanced first aid team must not have conflicting duties in an emergency and therefore should not be members of the fire fighting team or in an emergency of the marine crew.

### 9.3.1 THE MEDIC'S RESPONSIBILITIES TO THE ADVANCED FIRST AID TEAM

After an advanced first aid team has been formed and has received its initial training, the medic should be responsible for maintaining the level of skill of its members by conducting a regular program of on-the-job instruction in first aid and by arranging regular first aid drills, in the same manner that lifeboat drills are conducted.

The topics which should be presented by the medic to members of the advanced first aid team are essentially those covered in basic first aid with additional modules of training in the use of oxygen apparatus, the medical consequences of air transportation, the use of the sick bay equipment and the techniques of assisting the medic in resuscitation. The on-the-job training and drills should be supplemented by formal refresher courses held at least annually.

## 9.4 CONCLUSION

1. All offshore workers should be required to complete a basic first aid course which includes instruction on basic safety-oriented first aid, cardiopulmonary resuscitation, hypothermia, near-drowning and hydrogen sulphide poisoning.

2. The regulatory agencies should certify first aid courses specifically developed for offshore workers.

3. Visitors to the drilling units need not complete the first aid course, but should be accompanied by a regular crew member at all times.

4. The offshore workers should be required to repeat the course every three years or participate in one day modules of the course once a year.

5. There should be an advanced first aid team of not fewer than four crew members on each crew change who can provide support to the medic and escort services to evacuate casualties.

6. The medic should be responsible for maintaining the skills of the team through on-the-job training and regular drills.

## REFERENCES

1. Minutes of Medical Health and Safety Meeting, Ottawa, July 7, 1983, p. 4.

2. Norman, J.N.; "Training", Second Interim Report for the Occupational Health and Safety Study, April 1983.

3. Health and Safety Executive, "Guidance on First Aid Training Approval, Part II: Training", pp. 23-28.

4. Newfoundland and Labrador Petroleum Drilling Regulations, 1982 under The Petroleum and Natural Gas Act and the Occupational Health and Safety Act, Section 41, p. 124.

5. "Basic Offshore Survival Training(course outline)", College of Fisheries, Navigation, Marine Engineering and Electronics, Fall 1983.

6. Norman, J.N.; "What Medical Personnel are Needed and What Do They Need to Know", (Life Support Escorts), Interim Report on Ocean Ranger Study from Aberdeen, February 1983, p. 69.

Chapter 10

# STANDBY VESSELS

## 10.1 INTRODUCTION

In their operations throughout the world, MODUs are supported by other vessels; such as tugs which assist the MODU to enter ports, supply vessels which transport food, water and other supplies to the MODU at sea and a standby vessel which remains in proximity to MODUs and installations in order to perform anchor handling duties and to assist in evacuation and rescue. On the Canadian East Coast the support vessel at sea serves both as a supply and as a standby vessel. Further it must also monitor the movement of icebergs and when necessary tow the bergs from paths converging on the location of the installation.

## 10.2 FUNCTIONS OF STANDBY VESSELS

According to the NLPD Petroleum Drilling Regulations(1) the main functions of standby vessels are:

(1) to evacuate all personnel from the drill site when necessary

(2) to be equipped with first aid supplies in quantities suitable for the treatment of

- (i) at least ten persons having extensive second degree burns,
- (ii) at least five persons having arm or leg fractures, and
- (iii) at least five persons suffering from hypothermia.

(3) to maintain open communication channels with the drilling unit;
(4) to maintain the craft within such distance from the drillilng unit as is approved by the Director; and
(5) to stand ready with the craft to conduct rescue operations at any time

- (i) that the safety of personnel, the safety of the drilling unit or the safety of the well being drilled by that drilling unit is endangered or is likely to be endangered,

- (ii) when there is particular danger of a man falling overboard,

- (iii) when a helicopter is landing or on taking off from the drilling unit,

(iv) when diving operations from the drilling unit are in progress, and

(v) when the drilling unit is threatened by ice.

With the addition of serving in the evacuation of the drilling unit due to threat of ice, these functions are similar to those expected of standby vessels operating in the North Sea(2,3).

## 10.3 ADVANTAGES AND DISADVANTAGES OF STANDBY VESSELS

The Hollobone, Hibbert and Associate Limited report on the "Use and Effectiveness of Standby Vessels (Rescue Ships) in Offshore Operations" examines the question of whether standby vessels are a more effective means of rescue than an installation's rescue resources. The report outlines the following advantages and disadvantages of an independent rescue facility(4).

### 10.3.1 ADVANTAGES

(i) Rescue of people from the sea is easier from a mobile vessel.

(ii) Rescue from a source not subject to the difficulties arising at the site of an emergency heightens the chances of success.

(iii) The presence of a mobile, specialist rescue facility throughout an emergency and after evacuation or loss of the installation increases the chances of survival of installation personnel.

(iv) An external rescue facility is potentially better equipped to co-ordinate rescue operations than is an installation during a major emergency as, by definition, it can stand back from the actual scene.

(v) Rescue from the sea requires sound seamanship. An independent vessel can be crewed entirely by seamen, whereas the skills of most installation personnel (particularly on fixed platforms) do not include seamanship. So there may be very few seamen onboard who can assist with rescue.

(vi) The visible evidence of an independent and efficiently operated rescue facility heightens the morale of installation personnel.

(vii) An independent vessel can provide communication, command and control facilities during emergencies.

### 10.3.2 DISADVANTAGES

(i) Provision of a specialist vessel for rescue purposes adds to the cost.

(ii) Crews of such vessels, if not kept active, are subject to boredom and hence potential inefficiency.

(iii) Direct responsibility for rescue operations is not vested in the installation. This can result in a lack of interest in safety drills by installation personnel and rescue vessels.

(iv) If not reliably and competently operated, rescue vessels may themselves present a threat to installations.

The report concluded that, "on balance, the permanent availability of an independent rescue facility will provide the greatest chances of saving the lives of offshore installations personnel in both major and minor emergencies. Though in theory and practice, the incidence of such emergencies varies with the type of operation being undertaken on the installation, they can and do occur with all types of operation. This therefore does not affect the overall conclusion, though it may well provide good reason for altering the nature of the rescue facility to suit the operations being undertaken."(5)

## 10.4 COMPARISON OF ENVIRONMENTAL CONDITIONS OF THE NORTH SEA AND THE CANADIAN EAST COAST

In the North Sea, vessels are deployed as dedicated standby vessels for rescue and evacuation. In such areas as the Forties Field, where there are four installations in proximity with a composite complement of approximately 800 personnel, only one standby vessel is required.

Although the Hollobone, Hibbert and Associate Limited report provides a valuable overview and justification of the role of standby vessels in the North Sea the following unique characteristics of the Canadian East Coast must also be taken into account.

(i) On the Canadian East Coast the distance from shore to the MODUs is greater and weather conditions which prohibit flying are more frequent. In consequence longer rescue and transport times are to be expected. Thus the standby rescue facilities and MODU°s sickbays assume greater importance and they must be equipped and staffed to provide care for casualties for a significant period of time.

(ii) As indicated in the section of this report on Onshore Medical Resources, the medical facilities available onshore in Labrador and Northern Newfoundland are limited.

(iii) The very low temperature of water (-2°C) and air (-20°C or lower) and the high seas on the Canadian East Coast severely limit probable survival time in the water and in liferafts.

These additional factors suggest that there is a greater need for standby or rescue vessels on the Canadian East Coast than in the North Sea and further that the balance between onsite and independent rescue and treatment facilities must be re-assessed in the light of local conditions.

## 10.5 THE ROLES OF STANDBY AND SUPPLY VESSELS

Recently, the Norwegian Government indicated that while MODUs are required to have a standby vessel in attendance, fixed installations are exempt due in part to the high cost and the poor record of rescue by these vessels(6). In Canada, there is some controversy as to whether standby vessels operating on the East Coast should continue to perform the dual role of standby and supply vessels or should be dedicated solely to the rescue role, as in the North Sea.

Granted that supply vessels which also assume the standby role are more cost efficient, the suitability of these vessels for rescue duties is questionable.

(i) The supply ships currently deployed in a standby role on the Canadian East Coast may be hampered in the retrieval of survivors from the water by their high freeboard which is necessary to prevent them shipping water in the high seas frequently encountered on the Canadian East Coast. Furthermore, rescue equipment such as scrambling nets which are intended to compensate for the high freeboard may introduce hazards due to the anticipated hypothermic state of the victims. In the section on hypothermia it is indicated that survivors may be unable to avail themselves of self-rescue facilities requiring physical effort.

(ii) The iceberg-towing duties of a standby vessel may conflict with its duties in evacuation or rescue. Iceberg towing would commence when the berg is a significant distance from the MODU. The standby vessel could then be too far away from the rig at the time of a disaster to render assistance, as occurred in the "Alexander Kielland" disaster.

One alternative may be to use the diving support vessel for rescue since active diving would be suspended in emergency conditions. High seas which preclude the use of the fast rescue boat which normally could be used for man overboard situations, would also preclude diving operations. Under these conditions the diving support vessel could respond to the emergency.

(iii) The transfer of personnel from a MODU to the standby vessel, would be difficult in high seas, especially if there is no helicopter support and/or no power to operate the rig°s cranes. The "Ocean Ranger" Marine Disaster demonstrated how

high seas prevented survivors, liferafts and lifeboats being retrieved from the sea.

## 10.6 ADDITIONAL MODES OF RESCUE - HOSPITAL SHIPS AND HELICOPTERS

In the U.K. sector of the North Sea there are several dedicated standby/rescue vessels, which are effectively hospital ships such as the "Tender Captain" and the semisubmersible "Iolair". The "Tender Captain" has limited helicopter access which severely limits its capabilities as it is difficult to transfer patients and medical personnel safely and rapidly. The "Tender Captain" which is located in the Northern sector has physicians on board and the "Iolair" which is located in the Forties Field has a medic. Consequently the usefulness of the operating room facility on the "Iolair" is dependent upon the possibility of transferring a physician to the vessel.

During the present exploratory drilling phase on the Canadian East Coast, such "hospital ships" are probably not a feasible alternative to standby vessels. A hospital ship cannot be in close enough proximity to provide cover to scattered drilling units. However, the feasibility of hospital ships should be reviewed during the development stage when the number of units increases.

On the Canadian East Coast, total reliance on helicopter rescue, including the use of aircraft based on rescue vessels, is probably not feasible due to the limited number of days when weather conditions permit safe flying. In poor flying weather the alternative is to transfer survivors of a lost rig to a neighbouring MODU or installation.

The need remains for rescue vessels to be in close proximity to each drilling unit. The manoeuvrability of the vessel under adverse conditions is important and it has been suggested that firefighting capabilities on the rescue vessel are necessary to effect rescue in some circumstances.

Further considerations of these issues is required before the uncertainty as to the purpose of the standby vessels on the Canadian East Coast is resolved.

## 10.7 THE MEDICAL ROLE OF STANDBY VESSELS

Current Canadian and Provincial regulations require that offshore drilling units be attended by standby vessels(7,1), but as indicated above, the medical role of standby vessels has not been clearly defined.

The COGLA and NLPD regulations have specified that there must be facilties on board the standby vessel to treat "ten extensive second degree burns, five limb fractures and five cases of

hypothermia". Unfortunately these numbers and types of casualties appear to have been chosen arbitrarily, thus providing a weak base for determining the training requirements of the standby vessel crew, the medical supplies to be maintained on board and the physical accommodations.

The number of fatalities worldwide have been published, but reliable figures for the proportions of various types of injuries are not available. Thus it remains difficult to predict the number of casualties from a given offshore accident.

Some indication can be offered of the types of accidents and injuries which can present in the rescue vessel.

10.7.1 TYPES OF INJURIES ANTICIPATED IN MAJOR OFFSHORE ACCIDENTS

Injuries may occur directly from an accident or during attempts to reach safety. The types of injuries which may be encountered in an offshore accident are:

(i) Trauma may be caused by the collapse of the drilling unit, falling objects, falls from a height on the drilling unit, falls into the water, and contact with loose gear or debris. It is not certain that rescue by pulling men directly on board the standby vessel should be attempted as the vessel's thrusters are dangerous to men in the water, and in a heavy sea the survivor may impact with the hull of the standby vessel.

(ii) Many survivors will suffer near drowning and the majority would be hypothermic to some extent. In the "Alexander Kielland" disaster, the rig was suddenly lost and many men did not have time to don immersion suits, or to launch lifeboats or rafts. To be effective in rescuing unprotected men in the sea the standby vessel would have to be in close attendance especially during the winter when the lower water temperatures result in a rapid onset of hypothermia.

(iii) If a MODU or installation suffers a blowout or fire the standby vessel may be required to conduct a dry evacuation. As personnel are transferred directly, they may not suffer from hypothermia. The number of burns will vary with the nature of the fire; individual burns are expected from a galley fire, and a substantial portion of a helicopter's passengers may be burned in a helicopter crash.

(iv) In addition to burns, helicopter crashes offshore have resulted in trauma including head and chest trauma as well as drowning. Many or all of the survivors of a downed helicopter in the sea would be expected to be hypothermic.

(v) In an explosion caused by flammable gas, etc. the number of burns, trauma and other injuries is highly unpredictable due to the variable factors such as the nature of the gas leak, the location of the explosion and any consequent fires, the success with which these can be contained,the wind at the time, and the accessibility of the victims.

Although specific injuries may be associated with certain accidents, it is common medical experience that accidents in heavy industry or helicopter crashes frequently result in the victim receiving multiple injuries such as limb fractures, with injuries to head, chest and abdomen.

Although substantial numbers of casualties may be anticipated, from a major offshore accident the records to date do not show that large numbers of casualties have been successfully picked up by standby vessels. In the Alexander Kielland disaster of the 212 persons on board only 89 were rescued. 57 persons were winched on board helicopters, 8 were lifted by personnel baskets on board the Edda platform, and the remaining 24 were taken on board four different supply vessels and a tug(8).

Similarly, during the period 1975 to August 1982, 23 men-overboard accidents were reported to the Norwegian Petroleum Directorate, 6 of which were fatal. Of these 23 accidents, only 2 were rescued by the standby vessel's pickup boat. Furthermore, a standby vessel's pickup boat was used to recover a body after a man overboard accident from a tugboat(9).

Future success in rescue by support vessels is dependent on the new technology which emerges for rescue. For example, improved technology for dry transfer between a threatened MODU and a standby vessel would decrease the likelihood of hypothermic casualties. If the technology for recovery of survivors from the water improved this risk of trauma during rescue would be reduced and the probability increased of injured, exhausted and hypothermic casualties being brought successfully on board.

### 10.7.2 THE ROLES OF THE CREW OF THE STANDBY VESSEL IN A MEDICAL EMERGENCY

Although the crew may have to care for several types of serious casualties such as hypothermia, near drowning, multiple injuries and burns it is not practical to deploy persons with the same qualifications as a rig medic aboard standby rescue vessels. During normal operations a medic would not have a sufficient work load to maintain his medical interests and skills with consequent loss of job satisfaction and a high turnover of personnel. In addition, the cost effectiveness of deploying a medic without a dual role is questionable.

These objections could be overcome by using a larger standby

vessel with more advanced facilities so that the medic could serve a number of MODUs. At present this is not feasible as the MODUs on the Canadian East Coast are located over too large a geographic area for such a standby vessel to be accessible to other vessels. Since rescue vessels must be in close proximity to the MODU or installation it seems likely that the use of smaller vessels as standby vessels to individual drilling units will continue.

## 10.8 MEDICAL ATTENDANT ON THE STANDBY VESSEL

Given the circumstances of the Canadian East Coast a feasible proposal is to train a member of the standby vessel crew to an advanced level of first aid since the anticipated medical problems encountered in offshore rescue attempts - hypothermia, burns, and serious trauma - are very difficult to manage.

In selecting a member of the crew to act as the medical attendant on board the standby vessel the following points should be considered;

(i) the vessel's master in an emergency situation would experience conflict between his marine and medical duties and therefore should not be the primary medical attendant aboard a standby vessel. However he should be exposed to the same training as his medical attendant to allow him to assess the advice he receives when reaching decisions which could affect the outcome for a patient.

(ii) the individual chosen must be someone of reasonable intelligence, experience and education who can be expected to remain with the ship for some time, possibly one of the ship's officers. However it would be necessary to ensure that the officer's medical duties would not conflict with his other shipboard duties to any significant degree.

In addition to having a designated member to serve as medical attendant when required the ship's complement should be trained in first aid in order to provide support for him. The crews of fast rescue boats should also receive basic first aid training especially in the resuscitation of the victims of an immersion incident. General training in first aid would permit self help among the crew as well as the ability to render help to others.

At present, there is a lack of consensus in the industry as to the necessary content of safety and first aid courses for standby vessel crews and the list of medical supplies to be carried by standby vessels (10). Appendix 10-A presents a suggested First Aid course for rescue vessel crews. It is suggested that the question of deployment, equipment and use of standby vessels for rescue in Eastern Canada deserve further study by mariners, rescue specialists, and physicians and others.

## 10.9 SUMMARY

1. In the Canadian East Coast operations supply vessels also serve as standby vessels.

2. The functions of standby vessels are set out in regulations.

3. On balance, the advantages of standby vessels outweigh their disadvantages. Under Canadian conditions this balance could be reassessed and in particular, the methods of rescue and of caring for survivors.

4. While it is not feasible to use them as "hospital ships", some medical facilities should be provided on supply vessels to allow them to deal with a range of anticipated casualties.

5. The record of successful rescue by standby vessels is not convincing to date. Improvements are required in methods of transfer to supply vessels and in picking up survivors from the sea.

6. While it is not appropriate to have a medic on a standby vessel, a designated officer should be trained in advanced first aid and all crew members should receive instruction in basic first aid.

7. At present there is no agreement on the level of first aid training and the medical equipment and supplies to be carried by a supply vessel.

8. The role of standby vessels in rescue should be studied by a group of experts.

REFERENCES


1. Newfoundland and Labrador Petroleum Drilling Regulations 1982 under the Petroleum and Natural Gas Act and the Occupational Health and Safety Act, June 1982. Sections 236, 238-239, pp. 122-123.

2. "Assessment of the Suitably of Standby Vessels Attending Offshore Installations; Instructions for the Guidance of Surveyors", United Kingdom Department of Trade, 1978, Section 1.3, p. 3.

3. Anderson, Dr. I.K., "Ten Men in a Boat" in Offshore Paramedicine Conference Proceeding, Edinburgh, March 9-10, 1983, pp. 49-61.

4. Report and Draft Guidance Notes on the Use and Effectiveness of Standby Vessels (Rescue Ships) in Offshore Operations. Prepared for the U.K. Department of Energy by Hollobone, Hibbert and Associates Ltd., November 1981, p. 14-15.

5. Ibid, p. 15.

6. "The Standby Boat Service on the Norwegian Continental Shelf", Report from a working group appointed to the Norwegian Petroleum Directorate, Spring 1983, Section 1.6.5.

7. Canada Oil and Gas Drilling Regulations, Canada Oil and Gas Lands Administration, November 1980, Section 18, p. 8.

8. "The Capsize of the Accommodation Platform Alexander Kielland in the North Sea", Report on the Search and Rescue Operation, The Rescue Coordination Centre Southern Norway, Stavanger, p. 7.

9. "The Standby Vessel Service on the Norwegian Continental Shelf", Report from a working group appointed to the Norwegian Petroleum Directorate, Spring 1983, Section 1.7.2.

10. Minutes of Medical Health and Safety Meeting, Ottawa, July 7, 1983, p. 3.

Chapter 11

# COMMUNICATIONS AND TRANSPORTATION

## 11.1 COMMUNICATIONS

### 11.1.1 INTRODUCTION

Communications channels are essential to the successful operation of any offshore hydrocarbon operation. The need for reliable and simple communications links is greatest when health care and safety are concerned. Communications refers to all aspects of contact between personnel and agencies on and within the installation, to and from support/rescue craft, hospitals and shore bases.

### 11.1.2 STATUTORY REQUIREMENTS

The Canada Oil and Gas Lands Regulations for 1980 (1) and the Newfoundland and Labrador Petroleum Drilling Regulations 1982 (2) require all drilling units to have a communication system which includes:

1) a very high frequency marine radio telephone,

2) a single side band radio,

3) a VHF aviation radio,

4) a low frequency radio homing beacon,

5) a radio capable of communicating with any support craft used in connection with drilling operations, and

6) a teletype or facsimile apparatus for the transmission of written data to and from the shore base.

The drilling unit's internal communications system includes a standard rig telephone exchange, a self-powered telephone system, intercoms and/or walkie talkies, and a public address system. These systems should be located so that voice communication to all parts of the unit is possible at all times. An internal television monitoring system with two way audio is available on most drilling units.

### 11.1.3 COMMUNICATIONS IN HEALTH CARE AND SAFETY

Within the rig or installation it is essential that telephones in the sick bay or hospital room are conveniently located and that a "hands off" telephone is available when a medic's duties prevent

him from using the telephone in the usual manner.

One-on-one voice or telephone communications are best but this may not be possible at times. Communications through another person acting as an intermediary, or messenger, although less desirable at best and dangerous at times, may be necessary. When a messenger must be used, first aiders with advanced training and knowledge of the sick bay and other facilities should be selected to play this role. Where possible, all instructions should be confirmed by teletype or other system which will produce a printout or hard copy of the message(3). Maintaining communications with a physician while he is being transported by helicopter to an offshore site presents particular difficulties and messages may have to be relayed from the drilling unit to air traffic control, then to the aircraft(3). To avoid distortion, a backup physician should be called in to the shore base to maintain liaison with the rig medic until the first physician reaches the site.

### 11.1.4 COMMUNICATIONS SYSTEMS

External communications or telecommunications for decades has depended upon high frequency radio and later very high frequency (VHF). These systems usually provide a reasonably satisfactory service. There are, however, a number of significant problems, some potentially serious. Radio communication can be disrupted by the elements and geography, and for variable periods of time may be out of service. Communications between standby vessels and shore may have to be retransmitted from the rig and an unsatisfactory HF link compounded by difficult or incomprehensible accents may result in seriously defective communication. Crowding of limited channel space by other legitimate users or by curious although well-intentioned amateurs can further jeopardize communications in an emergency. The lack of confidentiality in communication is of concern during routine industrial use, and, in the case of health care, can interfere with a thorough discussion of problems. Concerned relatives may receive uninterpreted and sometimes frightening information from "listeners in".

In an emergency situation there are rarely enough channels for communication and a serious medical emergency may not take precedence over other needs of the rig. Communications between lifeboats, rigs and helicopters present particular problems, again because of the distortion and confusion which can arise when messages are relayed through intermediate stations.

### 11.1.5 COMMUNICATIONS SYSTEMS BEING DEVELOPED

More than a decade ago satellite communication became possible. Alternative systems for fixed rigs include trophospheric scatter systems, which are reliable, but expensive. At present, these are not a practical consideration in Atlantic Canada, as the large and

expensive terminal required cannot be stabilized on a MODU. There have, however, been some recent developments which suggest that trophospheric scatter systems could be modified for use on MODUs.

Inmarsat is an expensive but reliable commercial satellite system which offers the convenience of an ordinary telephone system. Charges include not only the satellite channel cost to the homing or down link in the eastern U.S. or the U.K., but the long distance charges to the company's base. This international satellite system is available on most MODUs but because of expense its use is limited to emergency and other special uses. The Inmarsat service is not available on standby vessels, service vessels, diving barges, support vessels and helicopters. For this group of ships and aircraft, HF and VHF channels will continue to be required for years despite the new technologies.

Recent developments in satellite technology point to the provision in the near future of reliable channels at reasonable cost. Currently a pilot project is in progress in Atlantic Canada to test how Canada's 14 and 12 GHz Anik B satellite system can be applied to offshore health needs.

Using this satellite, Memorial University, the Federal Department of Communications, the Newfoundland Telephone Company and Mobil Incorporated are jointly conducting a pilot study using an automatically steered terminal on a Mobil semisubmersible, the SEDCO 706 in Hibernia. The Memorial Telemedicine group are demonstrating a reliable voice link and exploring the use of two telephone channels to support medical care on the rig. By using slow scan equipment, television pictures can be sent to the shore-based hospital so that electrocardiograms and other visually presented medical data can be transmitted. The satellite provides a direct link to the Emergency Department of the Health Sciences Centre 24 hours a day. Early results indicate that telemedicine techniques can significantly enhance the ability of a shore-based physician to provide advice to the medic on the rig.

This system can be used not only to link the sick bay with the hospital and the onshore physician but also to provide a direct voice link to other parts of the rig including the hyperbaric chambers if necessary. Pictures can also be sent from these areas so that a diver in saturation can be monitored and treatment directed by a specialist onshore. When not being used for medical or industrial purposes, this telemedicine system will also provide entertainment.

It is anticipated that within a year this type of satellite communication will be commercially available at reasonable costs for use on the Canadian East Coast offshore. In the meantime, the same reliable communications link can be available using the Inmarsat system.

As noted earlier, these satellite communications are not available for standby vessels and many other ships. This deficiency will probably be rectified if the current Canadian mobile satellite (M-Sat) program proceeds as planned. This proposed narrow band system - a world first - is expected to provide relatively inexpensive satellite communication links by way of small terminals which will be virtually hand-held and are planned to be used on ships, offshore oil rigs, and even motorized land vehicles. The launch of this large satellite, able to accommodate up to 3000 telephone channels, is planned for 1987 and the service should be commercially available within a few years thereafter. A number of oil companies and Memorial University have signified their intention to participate in the first phase of this project.

Although other systems are being considered, it is likely that for the next decade only satellite links will provide reliable and confidential telecommunication links with the Atlantic offshore. Such links will only provide the "highroad" for communication. The traffic will include voice and data transmission including slow scan television, ECG, EEG, temperature, breath sounds and others. Health care will need a relatively small amount of the time on the satellite system. The main use of the links will be for industrial purposes, and with this wider application the system will probably be cost effective. Education, training, personal telephone use and entertainment will further make satellite communication valuable in the offshore.

Given that clear lines of communication must be established and maintained as an integral part of the services to offshore installations, a clear protocol must be developed to cover the proper use of the equipment, the conditions under which it can be used, the operating procedures and maintenance, and the recognition of faults and errors. Regardless of the technology used, the human factor determines the success of any communications system. Personnel should be trained in the appropriate procedures and a roster established to ensure that the system is adequately manned at all times and under all conditions.

## 11.2 TRANSPORTATION

### 11.2.1 INTRODUCTION

Much of the experience of supplying health care to the offshore oil industry has been gained in the operations in the Gulf of Mexico and the North Sea. Compared to the Gulf of Mexico, distances on Canada's east coast are far greater, and the weather is more severe. Although the Gulf is subject to violent storms, the average wind speeds in this region are lower. Distances considered long in the North Sea are comparable to the shorter distances on Canada's east coast (Halifax-Venture, St. John's-Hibernia). The Canadian weather is more stormy, fog more

prevalent, and the temperatures of sea and air are substantially lower.

In this section, the medical implications of sea and air transportation are considered and the available resources are catalogued briefly. The special problem of transporting divers under pressure will be considered in the section on diving.

## 11.2.2 DISTANCE AND TIME

The average ground speed for helicopter transportation is 145 kilometres per hour, depending on air speed, wind direction and velocity, and precipitation conditions. The average cruising speed for supply vessels is approximately 11 knots (20 kilometres per hour), depending again upon weather conditions and state of the sea(5).

Based upon these average speeds and the approximate distances from St. John's to each of the indicated destinations, the following journey times were derived:

| Journey | Approx. distance (kilometres) | Approx. Helicopter flying time (hrs) | Approx. time by supply vessel (hrs) |
|---|---|---|---|
| St. John's to: | | | |
| Continental shelf margin | 611 | 4.2 | 31.7 |
| Hibernia | 321 | 2.2 | 16.7 |
| Ungava Peninsula | 1609 | 11.1 | 92.8 |
| Botwood (supply base) | 257 | 1.7 | 13.33 |
| Cartwright | 740 | 5.1 | 38.33 |
| Hopedale | 1046 | 7.2 | 54.16 |
| Marystown (shipyard) | 193 | 1.3 | 10.00 |
| Goose Bay | | 2.5 | |
| Halifax to Venture | 338 | 2.3 | 17.5 |
| Canso to Venture | 187 | 1.3 | 9.7 |
| Halifax to St. John's | 917 | 6.3 | 47.50 |

Source: Bartlett, R; "Problems in Providing Medical Support for Remote Diving Operations", Canadian Offshore Technology Conference II, Toronto, March 1983, pp. 3-5.

Time for refuelling and completing transfers would have the effect of increasing the time of the trip. Further, the time of arrival at the drilling unit will be delayed by the time required for the medical personnel to assemble and travel to the airport. In St. John's, on occasion, the MERT may be picked up at the Health

Sciences Centre helipad.

More realistic transport times can be obtained from considering the sequence of events. In transporting a patient from Hibernia to St. John's there will be a minimum delay of about 1/2 hour for communication, decision and preparing the helicopter, followed by a flying time of 2 1/4 hours, at least 1/4 hour for patient transfer, etc., on board the MODU, a 2 1/4 hour return flight, and a few minutes to transfer the patient from helipad to emergency department. This gives a total transport time of not less than 5 1/4 hours.

A crew member sustaining an injury requiring tertiary care (e.g., a head injury) on a drillship operating off Northern Labrador will be evacuated by helicopter to Goose Bay, which is a 2-1/2 hour trip if a helicopter is immediately available, or a 5-hour return trip At Goose Bay the patient will be transferred to a fixed wing aircraft which requires approximately 1/2 hour, and the trip to St. John's is approximately a 2 1/2-hour flight to St. John's airport, followed by about 1/4 hour ambulance transport to hospital. With the addition of 1/2 hour for communication and decisions, the total time for patient transport off Northern Labrador to St. John's could be as long as 8 3/4 hours.

## 11.2.3 WEATHER CONDITIONS

Weather may significantly delay an urgent patient transfer by several days. The basic meteorological problems in order of importance are fog, high winds and icing conditions or snow.

According to the meteorological station at St. John's airport, fog is present on the average:

| | |
|---|---|
| St. John's airport | 123.3 days per annum |
| Gander | 76 " " " |
| St. Anthony | 58.6 " " " |

This does not mean that flying was prohibited on all of these days but it does indicate that take-off may be delayed on a significant number of occasions Even if weather conditions are good at the airport, transfer may be rendered impossible by fog, icing conditions, or high winds offshore. In transferring a patient to a helicopter from a supply vessel rough seas may make the winching operations hazardous.

High wind speeds are only occasional problems but helicopters do not cope well with icing conditions, which are present fairly frequently.

## 11.2.4 LANDING FACILITIES

| | |
|---|---|
| St. John's | Airport approximately 15 minutes from hospital; helicopter and fixed wing. |
| | Lighted helipads at Health Sciences Centre and Janeway Children's Hospital. |
| | Emergency helicopter landing area at Grace General Hospital. |
| Gander | Airport within 5 minutes; helicopter and fixed wing. |
| | Coordination centre for Search & Rescue Operations. |
| Goose Bay | Unlighted helipad adjacent to hospital. |
| | Airport in close proximity. |
| St. Anthony | Unlighted designated helicopter landing area adjacent to hospital. |
| | Local air field - light aircraft only. |
| Cartwright | Limited landing facility for light aircraft, helicopters. |
| Hopedale | Limited landing facility for light aircraft, helicopters. |
| Burin | Unlighted designated helicopter landing area adjacent to hospital. |
| | Airport with limited landing facilities 12 miles distant. |
| Halifax | Heliport facilities recently established in harbour area, near to the hospital. |
| | Airport approximately 20 miles distant (1/2 hour in light traffic). |

11.2.5 AMBULANCE SERVICE IN ST. JOHN'S

The role of ambulances is to transport patients from airfields or other points of arrival onshore to a hospital.

The St. John's metropolitan area is served by a single ambulance service covering an area of approximately forty kilometres radius from its base at the Health Sciences Centre with a total of six van-type ambulances, each capable of carrying two patients. This service is funded by the Provincial Department of Health and is administered by the General Hospital Corporation, Health Sciences

Centre.

Access to this service is usually through the metropolitan 911 telephone system, but it can also be contacted directly by regular telephone or by VHF radio connected to the Emergency Department of the St. John's hospitals and to the radio dispatcher at the Royal Newfoundland Constabulary headquarters at Fort Townshend, St. John's.

Medical direction for ambulance calls is provided by the emergency physicians on duty at the Emergency Department, Health Sciences Centre, and a medical intern in this department is available 24 hours a day to accompany the ambulance on emergency calls which require the services of a physician. Of the eighteen ambulance attendants employed, eight are certified to the Canadian Medical Association, Emergency Medical Attendant, Level I, while the others have completed Cardiopulmonary Resuscitation and Emergency First Aid Courses.

Each vehicle is equipped to provide basic life support. If advanced life support is needed, the necessary drugs, equipment and physicians are taken from the Emergency Department, Health Sciences Centre where they are available exclusively for this purpose. (See Appendix 11-A for Ambulance Supplies & Equipment). Backup ambulance services in the metropolitan area are provided by the St. John's Fire Department, St. John Ambulance and the Canadian Red Cross.

### 11.2.6 AMBULANCE SERVICE OUTSIDE ST. JOHN'S

Longer trips by ambulance may be necessary if weather conditions at St. John's airport prohibit landing. For example, an injured offshore worker might have to be transferred by ambulance from Marystown to St. John's. A patient with a condition such as a head injury which could only be treated definitively in a tertiary care facility in St. John's may have to be transported by ambulance from Gander or elsewhere.

Ambulance services outside the St. John's area are one-man ambulances, therefore an attendant is not available to care for the patient while the vehicle is in transit unless an escort is sent from the referring hospital. An escort is essential for transporting seriously ill patients as the level of training of the ambulance driver/attendant tends to be lower than that in the metropolitan area.

### 11.2.7 AMBULANCE SERVICE - SUGGESTIONS FOR IMPROVEMENT

i. In addition to the presently identified ambulances of The General Hospital Corporation, St. John Ambulance, Canadian Red Cross, St. John's Fire Department, resource transportation vehicles capable of carrying patients on

stretchers should be identified and inventoried.

ii. Provision should be made for the purchase of modular type ambulances in which advanced life support may be performed.

iii. Ambulance attendants should be trained across the Province to at least the Canadian Medical Association Emergency Medical Attendant I level. The problem of single man ambulance services must be addressed.

11.2.8 NOVA SCOTIA

In Nova Scotian waters the problems, though still significant, are less severe. Fog is somewhat less prevalent and water temperatures are higher. Halifax airport is approximately a 1/2-hour drive, under favourable conditions, from the main tertiary care hositals in Halifax. With rush hour traffic this driving time can be significantly increased thus delaying both the transportation of physicians offshore and the transportation of patients from the airport to the hospital designated by the company physician or the medical emergency response team leader. Ground transportation time has been significantly decreased as the Halifax Harbours Board permits the oil companies to use its helipad located in the Halifax Harbour area for offshore emergencies(7). The Study advisors in Halifax have indicated that ambulance services in Nova Scotia are adequate.

11.2.9 PATIENT TRANSPORTATION ON BOARD SHIP

Transporting wholly by supply vessel or other ship commits the patient to a long period of relative isolation from skilled medical help as the medic cannot leave the remainder of the drilling unit's complement without medical aid. In some cases the patient would be escorted by a crew member trained in advanced first aid, either from the drilling unit or from the supply vessel(Refer to section 9.3). At present suitably trained escorts may not be available in some cases.

During transport, the patient or attendant who may not be used to the motion of a relatively small vessel in a heavy sea, may experience seasickness. As discussed in the section on lifeboats, the consequent dehydration, exhaustion, and electrolyte imbalance may adversely affect the outcome of the patient's illness, particularly where there is fluid loss and shock. Further, medications given for seasickness may be contraindicated in certain medical conditions, e.g., head injury.

As supply ships have less sophisticated communication systems than MODUs, communication with a shore based physician during transport can be impaired.

The section on Standby Vessels presents a detailed discussion on

the medical supplies and equipment on the standby vessel and the proposed qualifications for the medical attendant on board. While the level of medical supplies and first aid training would be a known quantity on supply/standby vessels, these would be virtually unknown on other ships or "vessels of opportunity" as they will vary with the country of registration.

As alternatives to standby vessels, the Canadian Coast Guard does have Search and Rescue vessels which have sick bays and several are equipped to land helicopters. Appendix 11-B presents detailed information on the Canadian Coast Guard vessels. However only one Coast Guard vessel has a registered nurse as a crew member. These vessels have wide duties and the probability of one being within useful range in an emergency offshore is not high.

In view of the above considerations it is unlikely that the patient's best interests would be served by being transported by ship. It would be better for him to be taken to or kept aboard the MODU or offshore installation to await the arrival of the medical team, or the opportunity to transport him to shore by air.

A patient or casualty on board a supply vessel could be winched to a helicopter. This operation may be hazardous in inclement conditions and the only alternative may be to continue to transport him by sea.

### 11.2.10 AIR TRANSPORTATION

In spite of the restrictions imposed by weather onshore and offshore, and the hazards of winching, transport by air is the preferred mode for medical evacuation from MODUs or vessels offshore.

As before, seriously ill or injured patients being evacuated by air should be accompanied by a suitably trained escort. Ideally escorts should be trained to an Emergency Medical Technician level (e.g., CMA Emergency Medical Attendant III), but the requisite training period is two years and given the rate of turnover of workers in the offshore oil industry, this ideal may never be realized in practice.

It is suggested that the escort be chosen from the drill unit's Advanced First Aid Team, trained to deal with problems of aeromedical evacuation, such as the use of oxygen apparatus, suction apparatus, and airway management. As suggested previously, at least two members of this team on each MODU should be trained to the Level I CMA Emergency Medical Attendant to function as escorts.

If the patient has problems which are beyond the capabilities of this Advanced First Aid team, optimal management could be achieved

by first stabilizing the patient on the drilling unit and then transporting a physician or medical team to return with him to onshore medical facilities.

Although helicopters normally cruise at relatively low altitudes, some modern machines are capable of higher cruising altitudes. As they are unpressurized the effects of altitude may be harmful to the patient.

Noise and vibration in these aircraft can also present problems in patient examination and treatment in that it is difficult to use a stethoscope to listen to heart sounds or to get a reading from a standard blood pressure machine in some helicopters.

Fixed wing aircraft have less noise and vibration (in general) but many light aircraft are very cramped so that access to the patient is limited. The escort may find it difficult to manage the airway in flight when access to the patient's head is limited.

For these reasons, it is best to stabilize the patient as far as possible and to have planned and prepared any treatment likely to be needed in-flight prior to take-off.

In deciding to use air transport, it is important to establish in advance whether the medical equipment to be carried is compatible with the electrical supplies of the aircraft, and whether there are likely to be problems in stowing oxygen cylinders (a logistical difficulty in aircraft which are only used as occasional air ambulances).

Appendices to this section include a) a brief overview of the current availability of helicopters in Newfoundland and Labrador (Appendix 11-C) and b) excerpts from the document "Air Ambulance Guidelines" published by the U.S. Department of Transportation and the American Medical Association (Appendix 11-D). This includes a brief introduction to the technical medical problems involved.

## 11.3 SUMMARY

1. The requirements for communications in offshore operations are covered by regulations. These cover communications within an installation, to and from other vessels, to and from onshore bases.

2. For health purposes, the sick bay should be capable of communicating with other parts of the installation and to shore bases.

3. HF and VHF systems are in widespread use but have some limitations. Alternative systems in use or being developed include trophospheric scatter, Inmarsat, and newer satellite techniques.

4. Advances in telemedicine are being undertaken, including slow scan transmission to relay medical data. This system can be extended to other vessels by the development of the Canadian M-Sat program.

5. Distances and transport times in the Canadian East Coast are listed for transport by air and by sea. Onshore ambulance transport is reviewed.

6. Although weather conditions may restrict the use of air transportation facilities, this form is preferable to transportation by sea.

7. Air transportation of a patient or casualty requires the services of a trained escort and special planning to house support equipment during flight.

8. Drawbacks to air transportation are noise and vibration, cramped conditions on the aircraft, the effects of high altitude, which complicate care and monitoring of a patient during flight.

## 11.4 CONCLUSIONS

1. Reliable communications systems are needed for routine offshore operations for maintaining health care and are vital in emergencies.

2. Limitations of current systems are recognized and satellite technology must be developed to produce cost-effective alternatives.

3. Communications systems are only as effective as their users so training of operators and other personnel is required to ensure that the system can be used effectively under all conditions.

4. The role of transportation and the mode used for evacuation or transfer are dependent on weather conditions both onshore and offshore. Generally, transport by air is preferred to transport by supply vessel, but special planning is required.

5. Generally, the patient should be stabilized before being transported and an escort should be available to accompany the patient during transport by whatever mode is chosen.

6. Ambulance services can be improved by the provision of vehicles capable of offering advanced life support. Attendants should be trained to at least the CMA Emergency Medical Attendant level I standard, and steps should be taken to avoid one man ambulances. For emergency planning, an inventory should be taken of suitable vehicles from other resources.

## REFERENCES


1. Canada Oil and Gas Lands Administration, "COGLA Drilling Regulations", Office Consolidation, November 1980, p. 22.

2. Newfoundland and Labrador Petroleum Drilling Regulations 1982 under The Petroleum Natural Gas Act and the Occupational Health and Safety Act, June 8, 1982, p. 102.

3. Cox, R.A.F.; "Offshore Medicine: Medical Care of Employees in the Offshore Oil Industry", Springer-Verlag, 1982, p. 70.

4. Williamson, D; "Telecommunications in the Energy Field", The Journal of Canadian Petroleum, May-June 1982, pp. 68-71.

5. Bartlett, R; "Problems in Providing Medical Support for Remote Diving Operations", Canadian Offshore Technology Conference II, Toronto, March 1983, p. 4.

6. Colohan, D; "Emergency Medical Response to the Offshore Environment", Related Papers for the Occupational Health and Safety Study, Memorial University of Newfoundland, June 1983, pp. 7&8.

7. Minutes of Second Meeting to Consider Emergency and Urgent Offshore Medical Response Capacity, Centre for Offshore and Remote Medicine, Memorial University of Newfoundland, March 31, 1983, p. 4.

Chapter 12

# DIVING

## 12.1 INTRODUCTION

It is claimed that only minimal diving support is needed during exploratory drilling operations. However experience has shown that this is not always the case, particularly when older rigs and systems are used and when problems arise with the drilling or marine operation itself. Thus in 1982 and 1983 a considerable number of diving operations have been carried out in Newfoundland and Nova Scotian waters, involving both one atmosphere diving and ambient pressure diving, ranging from dives using surface-supplied air to extensive saturation diving operations.

In this chapter, many of the issues discussed in other parts of this report will be examined in the context of health and safety in diving.

## 12.2 REGULATIONS

Health and safety in diving in Canada have recently been addressed in a new Canadian Standards Association (CSA) standard for diving and hyperbaric work and by the publication of draft regulations by Canada Oil and Gas Lands Administration (1) for diving carried out under their jurisdiction.

Comparison of Canadian regulations with U.S. Coast Guard Regulations, Norwegian Regulations and British Guidelines shows that for the most part, the Canadian documents reflect modern diving practice throughout the world. The Norwegian Diving Regulations are extensive and detailed. The British Guidelines are broadly compatible with the Norwegian Regulations but allow more scope for interpretation and judgment. U.S. Coast Guard Regulations are perhaps the most permissive in that they permit surface decompression or in-water decompression techniques with a wet bell to much greater depths. The Draft COGLA Diving Regulations are the most extensive detailed regulations currently in use.

From this comparison, it might appear that there is little need to comment on Canada's position on health and safety in diving. However, three problems can be identified.

First, there is some lack of consistency between the CSA standard and the Draft COGLA Regulations (5). The inconsistency is unfortunate, but would only be of great importance in areas of contested jurisdiction.

Second, the Draft COGLA Diving Regulations do not address surface

decompression diving (7). This omission is inconsistent with practice in the rest of the world (4) and may have disadvantages for safety. A prospective study of the safety of surface decompression diving operations would be required to clarify the justification for this restriction. On the other hand, while British and Norwegian Regulations only permit the use of SCUBA by special dispensation, Canadian Regulations permit the use of SCUBA to 60' depth. This may cause conflict with the requirement to record communications, since communications through water can be limited by the effects of sonar and ships thrusters and contact may be lost with a diver using SCUBA.

A third problem is that the Draft COGLA Diving Regulation covers the training of divers and diving supervisors extensively while the training of life support technicians is only briefly addressed(5). These support personnel have one of the most technically demanding jobs in the industry and a training program should be developed for them as a matter of some urgency.

### 12.2.1 CONTINGENCY PLANS

As discussed in Chapter 14, company contingency plans are subject to scrutiny by the regulatory agencies. These plans should cover the evacuation of divers in the event of abandonment of the MODU or vessel. Contingency plans for the rescue of divers trapped in a diving bell on the sea bottom should demonstrate that a rescue operation can be undertaken within the time available for life support in the bell system. This is of special concern in one atmosphere diving operations(6), where the main danger is entrapment of the vehicle.

### 12.2.2 PROCEDURES MANUAL

COGLA Draft Diving Regulations provide for a detailed review of procedures manuals by the regulatory bodies, prior to the granting of contracts. Deficiencies in these can be corrected by consultation between industry and government. Because diving technology is constantly changing, these procedures manuals should be reviewed on a regular (possibly yearly) basis, using continuously updated sources such as the publications of CIRIA Underwater Engineering Group(8) and the diving safety memoranda issued by the U.K. Department of Energy.

Company manuals should delineate clearly the responsibilities for each employee, and set forth the disciplinary policy of the company specifying that horseplay, disregard of safety instruction, disobedience of supervisors' orders, or possession or consumption of alcohol or drugs of abuse will not be tolerated.

## 12.3 ENFORCEMENT OF REGULATIONS

Diving regulations may be enforced and policed by:

i. enforcement by government inspection which has obvious advantages, but depends on a supply of highly trained and experienced inspectors, who must be hired in competition with an industry paying high salaries to those best suited to such posts.

ii. enforcement by contract whereby operating companies are required to assume responsibility for the health and safety of their diving subcontractors. The contract proposals should be examined to verify that they set out acceptable standards, and that the safety department of the operating company will conduct inspections to ensure that such standards are met and maintained. Unfortunately, many operating companies lack sufficient in-house expertise in diving to discharge this duty effectively.

Enforcement is difficult when regulations are drafted which cannot be met in practice. If the regulatory body has to permit exceptions and dispensations, the regulations and the regulatory body are brought into disrepute, and precedents are set for poor standards or practice.

## 12.4 COMMUNICATIONS IN DIVING

A secure communication link between divers and the surface is required for operations, but also serves safety needs and is vital in dealing with an emergency. Current regulations require that these communications be recorded on tape and the tapes kept for a specified period, to facilitate the investigation of diving accidents.

Again for operational and safety purposes there must be excellent video and audio communications between those within the chamber and those outside running the dive. When a diving casualty is being treated the person inside the chamber must be trained to communicate his findings accurately. Performance inside the chamber will be impaired by nitrogen narcosis or by the high pressure neurologic syndrome, so the senior person making decisions should always be outside the chamber and in close communication with the person inside who is acting as the eyes, ears and hands of the medical team.

Communications between the diving supervisor and the rig medic and the shore-based medical physician should be worked out in advance and contingency plans prepared to obtain the services of an appropriately trained medical practitioner. Communications from the diving station to the shore should be direct since there is a danger that even a knowledgeable person may garble relayed messages. Experience with radio links to shore in Newfoundland has not been very satisfactory and for the management of a diving accident, the use of a satellite telephone link backed, if possible, by Telex is usually necessary to pass the very detailed

information and instructions.

## 12.5 DIVING ACCIDENTS

A number of recent diving accidents occurred when diving was undertaken from dynamically positioned vessels. Guidelines have been issued by the Norwegian government (9) and in several memoranda prepared by Commander Warner of the U.K. Department of Energy. It will be important to ensure adherence to the standards being prepared for reserves of power and backup control systems for these vessels.

Several of these recent accidents have involved loss of a diving bell (10, 11, 12, 13, 14). In these situations precautions must be taken to guarantee thermal protection and adequate life support reserves for divers. In particular, the diver should have ready access to the bell from outside, if the umbilical or load line to the surface is severed and the bell comes to rest on the bottom of the sea (15).

If surface supply fails a diver can use a "bail out" system, that is, the supply of compressed gas which the diver carries to give him some reserve. As diving goes deeper, the useful time gained from a cylinder of a size capable of being carried becomes less and less, according to Boyle's Law. Some companies have explored the possibility of using hyperoxic mixtures in the bail out bottle in order to extend the diver's survival time but alternative bail-out systems for deep diving should be developed, presumably in the form of closed circuit systems.

## 12.6 TREATING THE SICK/INJURED DIVER

A team of individuals is required to look after the sick or injured diver in the offshore oil industry. Should the diver be in saturation it might require several days to bring him to the surface, and in deep diving operations it can take many hours to compress an attendant in order to have him enter the chamber in a fit state to render treatment.

### 12.6.1 IMMEDIATE FIRST AID

First Aid to the diving casualty will be rendered by his fellow divers. If the problem arises in the a diving bell the diver will usually have only a single companion. Thus all divers must be trained in first aid to a high standard.

Specifically, a safety oriented First Aid course lasting sixteen to twenty-four hours would have to be supplemented by two hours of instruction in hypothermia, a basic CPR course taking eight hours and eight hours of instruction in diving medicine with particular emphasis on first aid of diving emergencies. The specialized techniques of diver recovery into and resuscitation in the diving

bell must be taught. Regular drills should be carried out by each team in order to maintain a high standard of competence in diver recovery and resuscitation.

12.6.2 CONTINUED TREATMENT

The diver may require intervention beyond first aid, such as establishment of an intravenous infusion, detailed medical examination or endotracheal intubation. It can take at best some hours for a physician to reach the site of diving operations, and, with adverse weather conditions, it could take days. The most obvious person onsite, the rig medic, may not be able to provide these services since he may not be medically fit to dive and in deep saturation diving, placing the rig medic in saturation would deprive the rig of medical coverage for a period of days, which is unacceptable.

The diving supervisor, who may be the most experienced person present, cannot enter the chamber and render hands-on medical care, since he is forbidden by regulations and by common sense to leave the surface and the diving station.

For these reasons the practice has arisen of employing diver medical technicians on the diving team who are trained divers but have also been trained to provide emergency medical services. They are in a somewhat similar position to so-called paramedics or emergency medical technicians in the United States.

12.6 ONBOARD MEDICAL FACILITIES

The priorities in handling an offshore diving accident are first to recover the diver into the onsite recompression chamber and then to treat him using onboard resources of colleagues, the diver medical technician, the diving supervisor and the rig medic, in consultation with shore-based physicians.

The onboard diving team should be able to treat routine cases of pain only or so called type I decompression sickness but any more serious condition would require a physician specialized in diving medicine to be onboard as soon as possible. A diver in saturation who is injured or has developed an intercurrent illness, such as appendicitis, would be recovered into the saturation chamber. To avoid the risks of patient transfer under pressure it would be desirable to treat such a diver in the onsite recompression facilities. It is not possible to detail plans for every eventuality but, in general, treatment should be conservative.

12.6.4 THE NEED FOR BACK UP FACILITIES

In principle, surgery or complex intensive care should not be

contemplated in an offshore recompression chamber, since back up laboratory facilities and consultation with other physicians and specialists would not be immediately available or only after a long delay. However the possibility may arise of having to render complex care offshore, the most famous example being the partial disembowelling of the diver in a deck decompression chamber necessitating bowel resection. Several cases of appendicitis have been treated by conservative means.

The physician specializing in diving medicine should be prepared to go offshore and render quite complex aid in a recompression chamber, taking with him members of a Medical Emergency Response Team and taking the required surgical and monitoring equipment. The diving specialist could enter the chamber and perform treatment under the direction of the other medical specialist remaining outside, or the other medical specialist, if fit to dive, could perform the necessary manoeuvres in the chamber under the direction from outside of the specialist in diving medicine.

If intra-abdominal or other surgery were to be contemplated the special problem of using anaesthetics in the hyperbaric environment must be considered. In the North Sea operations safe and efficacious methods have been devised.

## 12.7 TRANSFER AND EVACUATION OF DIVERS

Transfer under pressure of a sick or injured diver to a shore-based facility might be needed for complicated trauma or illness. However a patient in an unstable condition should not be subjected to transfer under pressure since a period of relative isolation would be involved. Evacuation of the sick or injured diver should only be contemplated once the patient has been stabilized in a pressure chamber offshore(6). For this purpose a system resembling the diver rescue system operated by IUC Limited at Dyce, Aberdeen (16), might be adequate but it is appreciated that such a system would be rarely used.

A more serious problem arises in evacuating divers from a stricken or threatened MODU or platform, or diving support vessel. If a structure is to be evacuated because of a forecast storm or threat of iceberg collision, the diving crew would also have to be evacuated. Unfortunately, weather forecasting operates on a much shorter time scale than saturation decompression and the possibility arises of having to evacuate a structure when divers still require several days of decompression. Adverse weather and ice situations were noted in the Petroleum Directorate's report on operating conditions on the Hibernia and North Dana areas in February 1983(17). Any divers in saturation aboard the rig West Venture at this time would have been in serious jeopardy, for evacuation of the rig would have meant abandoning the diving crew.

There appears to be basically three options to deal with this

situation. The first is to arrange to have part of the diving system lifted or lowered from the rig aboard a support vessel by crane or by helicopter. The second is to provide a "fly-away" hyperbaric chamber for helicopter evacuation, and the third is to abandon the diving system by means of a hyperbaric lifeboat.

12.7.1 TRANSFER TO A SUPPORT VESSEL

Transfer of part of the diving system to a support vessel by crane or helicopter would mean that a fairly large amount of accommodation could be transported and that heat, electrical power, etc., could be available from the support vessel. However, this method could fail if this power were not available or if weather conditions prevented the use of helicopters.

12.7.2 THE "FLY-AWAY" HYPERBARIC CHAMBER

Plans to use a fly-away hyperbaric chamber for helicopter evacuation are also subject to adverse weather conditions. However, these conditions place the diving crew in the same degree of jeopardy as the other personnel aboard the vessel. The fly-away escape system is compatible with winching by crane onto the deck of a support vessel. Thus each diving system should be suitably equipped for helicopter transfer, but also with a means of access to the part of the diving system transferred to the helideck.

12.7.3 THE "HYPERBARIC" LIFEBOAT

Abandoning the diving system by a hyperbaric lifeboat would be a last resort. Such a lifeboat would be heavy, might not be seaworthy, and could be extremely vulnerable to being holed while being launched from a MODU, with the risk of rupturing part of the hyperbaric system.

Plans to use the diving bell as a hyperbaric lifeboat are not realistic. If the bell were non-buoyant, it would be in the "lost bell" situation with loss of thermal and life support systems (13). A buoyant bell would be subject to extremely violent motion and would expose its occupants to seasickness and serious danger of trauma. A bell is normally designed to carry only two men, not the entire complement of the saturation system. It also has limited life support and energy reserves and divers would be subject to hypothermia, exhaustion of the $CO_2$ scrubbing mechanism and of oxygen supplies. In retrieving the bell, damage from being dashed against the side of the rescue vessel could have fatal consequences.

The above three options could be combined in that a hyperbaric lifeboat could be designed so that the hyperbaric chamber in it could be lifted out and transferred by crane or helicopter. However, the technical problems of such a design have not yet been

addressed.

It has been suggested that diving operations should only be carried out from diving support vessels, which some allege would be less vulnerable than a MODU. However, there is no evidence for this claim and further study is required to determine the best solution for the conditions which may occur on the Canadian East Coast.

## 12.8 AN ONSHORE MEDICAL HYPERBARIC FACILITY

A study is being undertaken by the Health Sciences Centre of the needs for a hyperbaric medical facility in Newfoundland, its desirable site, and the type of facility has proceeded to a preliminary design stage. Briefly the study found that there was a need for such a facility not only for divers in the offshore oil industry but also for other shore-based commercial diving operations and for the growing number of sport divers in Newfoundland and Labrador as well as for hospital patients requiring hyperbaric oxygen therapy. The most logical site would be at the St. John's General Hospital because of the availability of laboratory and radiological facilities including CAT scanning, and a wide range of consultant and intensive care services.

To be used for transfer under pressure the depth rating should be in the region of 1000 feet of seawater and the chamber should also be able to deal with mixed gas diving (helium and oxygen) and saturation diving.

The chamber would accommodate at least two patients on stretchers, with a large entry lock and entry port to facilitate handling of stretchers, and a second entry port compatible with transfer of a patient to the chamber under pressure. The chamber itself could be modelled upon that in use at Aberdeen, Scotland. However, as Chinook and Labrador SAR helicopters are available in this region, a slightly larger chamber could be used since size and weight limitations would be less stringent. It might also be possible to utilize a two lock helicopter chamber which would greatly increase safety. However the study has not yet firmly determined whether this is possible.

## 12.9 TRAINING IN HYPERBARIC MEDICINE

In addition to the need for members of the diving team to be trained in First Aid, personnel with more specialized knowledge of hyperbaric medicine are required for diving operations.

### 12.9.1 TRAINING DIVER MEDICAL TECHNICIANS

The practice of having one of the life support technicians, whose normal function is to run the hyperbaric complex, cross trained as diver medical technician is expedient. The life support

technician is not at risk of becoming a diving casualty, but must, of course, be medically fit to dive.

Currently there are no courses available in Canada for diver medical technicians, and persons functioning in this role are trained in the United States. Unfortunately, as paramedics qualified in the United States cannot be registered in Canada there may be medico-legal complications for rig medics or physicians who have to relate to these workers. The drawback is that the diver medical technician trainee, having no medical or nursing status, cannot be allowed to perform medical procedures upon patients in his training.

However, appreciation of anatomical details can be achieved by using training models such as are widely available for demonstrating CPR, intravenous infusion, and intubation. By using anaesthetized animals the trainee can practice procedures such as sutures, the placement of chest and endotracheal tubes, and the establishment of intravenous infusions, and come to appreciate the feel of living tissue so essential to their practical performance.

The qualified diver medical technician could be recognized in the structure of medical services in Canada, if training were offered within the Canadian Medical Association's Emergency Medical Attendant programs, (CMA level I or II), such as are used for ambulance drivers and attendants. Additional modules would be required on near-drowning, hypothermia, diving medicine, the causation of diving accidents, procedures such as examination of the central nervous system and techniques such as intravenous infusion, intubation of the trachea. Such a course of training would take four to six weeks.

## 12.9.2 TRAINING OF OTHER DIVING PERSONNEL

Life support technicians should have a thorough appreciation of the illness or injury and of the procedures likely to be used in treatment. For this reason training in diving medicine should be part of the initial induction training. Indeed the life support technician would require this training to carry out his routine duties safely, even if there were no question of an accident or emergency.

The diving supervisor may be advised by diver medical technicians, rig medics, and physicians but he bears the responsibility for ordering and conducting treatment. Accordingly, diving supervisors should be trained not only in advanced first aid, but also in diving medicine and physiology, in recompression therapy and in most, if not all, of the training modules designed for diver medical technicians.

Since these emergency skills will seldom be required in a well

conducted diving operation, frequent practices and exercises should be held and refresher courses taken regularly by members of the diving team.

### 12.9.3 TRAINING OF MEDICS AND PHYSICIANS IN HYPERBARIC MEDICINE

The training and experience of the rig medic in general medical matters will exceed that of any member of the diving team and his expertise may be required in the case of diagnostic difficulty or doubt. Thus rig medics should be familiar with the concepts of diving medicine and physiology, and with operational diving procedures in order that they will not give conflicting or contradictory advice. They should also have some knowledge of requirements for medical fitness to dive so that they can advise any diver who consults them with a medical problem whether or not he is likely to be fit to dive. Medics should also be knowledgeable about the safety aspects of the effects of medications in diving as this is an area in which they are frequently consulted.

The company physician who supervises the rig medic should have a similar knowledge of diving medicine. In the event of a diving accident or illness he will usually require to call upon the expertise of a physician specifically trained in diving medicine. Canada Oil and Gas Draft Diving Regulation envisages two levels of training for physicians - those approved to perform medical examinations for fitness to dive and physicians specializing in diving medicine who are approved to undertake treatment of casualties.

### 12.9.4 TRAINING PHYSICIANS TO PERFORM EXAMINATION ON DIVERS

The basic requirements for approval to perform medical examinations for fitness to dive are similar in Canada, the U.K., and Norway. The physician should have taken an approved course, usually of two weeks° duration, in diving medicine and physiology with particular emphasis on the determinants of medical fitness. Such courses have been given in the U.K. by the Royal Navy and by the Institute of Environmental and Offshore Medicine in Aberdeen.

Currently the only course available in Canada is given at the Defense and Civil Institute of Environmental Medicine for military doctors. This course is five weeks long but as it is also intended for physicians in the submarine service, it contains a good deal of material extraneous to the purpose of approval for examination for fitness to dive. Because of the length of the course, few physicians can afford the time to attend. There is thus a need to develop in Canada a shorter recognized course specifically for physicians seeking approval to perform physical examinations for fitness to dive, developed and run by a university medical school.

It has not been found desirable in the U.K. and Norway to train large numbers of physicians in this way. Since the number of commercial divers is relatively small, having large numbers of physicians trained to perform medical examinations would mean that few of them could develop intensive experience in the field, particularly in the assessment of unusual or doubtful cases and in the interpretation of radiographs for dysbaric osteonecrosis.

## 12.9.5 TRAINING SPECIALISTS IN DIVING MEDICINE

The training of physicians specializing in diving medicine has been accomplished in the U.K. and Norway through a series of advanced courses of two weeks' duration sponsored by Shell Limited and given at the Institute of Environmental and Offshore Medicine of Aberdeen University, the Norwegian Underwater Institute, and at Comex Limited amongst other institutions. These courses revise basic material, emphasis the diagnosis and treatment of diving related illnesses, the investigation of diving accidents, and safe diving procedures. A considerable amount of practical instruction in diving is included since a physician unfamiliar with the techniques is at a disadvantage in advising a diving company and in making a diagnosis. It would seem desirable that a similar course be developed in Canada though the numbers may not justify it. Such a course of two or three weeks' duration would require to be repeated at approximately yearly intervals in order that these seldomly used skills are kept at a satisfactory level.

In fact in eastern Canada at the present time there is probably an adequate supply of physicians who have been trained and are approved to perform medical examinations for fitness to dive. There should probably be two more diving specialist physicians in Newfoundland and perhaps three in Nova Scotia. The most pressing need is for a series of refresher courses for those physicians who have already been trained.

## 12.10 GENERAL DIVER TRAINING

The skills and knowledge required by a commercial diver working in the offshore oil industry have been described by Zinkowski (2).

In addition to being knowledgeable, skilled, and practiced in the techniques of diving he will use, the diver must also have a basic knowledge of the physiology and medicine of diving and of first aid. All these skills and branches of knowledge can be acquired in a diving training school, but there are other skills which the diver will only learn by apprenticeship. While the recent emphasis has been on training in schools, there is no substitute for experience in acquiring the ability to judge weather, sea state, water temperature and visibility, and the implications of these factors for safety.

In addition, diving is only a means of getting to the workplace and a safe and effective diver must be amongst other things, an adequate seaman and boat handler, and a competent rigger, mechanic and welder. The need for the diver to be skilled in a number of areas is illustrated in the use of explosives underwater where the hazards to the diver are even greater than the hazards on the surface. The diver is as much at risk from committing errors in many other areas of his work as he is from making errors in calculating his decompression tables.

### 12.10.1 NUMBER OF DIVERS

On the face of it there would appear to be no difficulty in obtaining sufficient divers for there are already two schools teaching commercial diving in Canada, Senaca Community College and the Canadian Underwater Training Centre in Ontario. The output of divers from both these schools would easily provide sufficient numbers for the foreseeable future. However, if the output of schools is too high, too many divers will compete in the marketplace for a limited number of jobs and in consequence a) the level of wages will be reduced, thus providing a disincentive for the competent diver and b) the amount of experience available to each individual diver will be diminished.

1 While a number of divers in Canada have been trained in commercial diving, those with adequate experience of mixed gas and saturation diving and specifically of oil field commercial diving are in short supply. Since the industry tries to avoid diving operations during exploratory drilling the amount of experience that divers can gain from this source is necessarily limited.

These comments also apply to the supply of experienced diving supervisors. It has in fact been frequently necessary to bring supervisors from abroad to work in the Canadian East Coast operations. However, with time, more Canadians will become sufficiently skilled and knowledgeable to undertake this responsible role. The quality of diving operations depends to a very great extent on the quality of the diving supervisors and tight controls and regulations will be required to maintain high standards for their employment.

### 12.10.2 DIVING SCHOOLS

In the U.K. and Norway there are government backed diving schools, with regulations or guidelines which set minimum standards of experience and training for divers working in the North Sea. It is perhaps cynical to comment that these regulations and guidelines constitute a form of protectionism as they are so framed as to exclude divers from many parts of the world from taking part in North Sea operations.
In Canada there are plans to establish a diver training school in Nova Scotia. This school could concentrate upon areas such as

mixed gas and saturation diving, which are not covered to any great extent by the existing schools. Further, the standards of training should be set so that they could match or exceed the standards required in the U.K. and in Norway.

### 12.10.3 REGULATIONS ON DIVER TRAINING

Regulating high standards of training for divers is justified from the reports of investigations of diver accidents in which inadequate training appears as a frequent contributory though not necessarily sole cause of the accident. Many of the divers who died through losing their surface supply of breathing gas in the North Sea did not turn on their bail out bottles, an action which an adequately trained diver should take automatically. At present in Eastern Canada the extent to which the effects of hypothermia on a diver's judgment, performance and safety are ignored, is sufficient to justify insistence on a high level of training.

As indicated at the beginning of this chapter, adherence to the training requirements laid down in the Canada Oil and Gas Draft Diving Regulations would ensure a quality of diver training in Canada equal to anywhere in the world.

## 12.11 RESEARCH NEEDS IN DIVING MEDICINE AND PHYSIOLOGY

Diving health and safety is a field in which advances are occurring and research needs are being identified. The following areas are among those for which research programs are required:

i) as mentioned above, the development of better 'bail-out' gas supply systems for use in deep diving.

ii) oxygen toxicity, which limits the treatment of the diving casualty and its relevance to standards for decompression and dive exposure.

iii) prospective studies of various modes of diving to assess their relative safety. Comex, SA, of Marseilles, France, has a system of computerized record keeping which could be adapted for this purpose.

iv) the uptake and elimination of inert gas by the human body and the development and pathophysiology of decompression sickness to provide a rational basis for treatment.

v) thermal protection in diving. Although there have been advances at a practical level, the theoretical basis is not yet capable of allowing prediction from first principles in a situation which has not been encountered.

## 12.12 SUMMARY

1. A considerable amount of diving has occurred in the Canadian East Coat petroleum operations.

2. Canadian diving regulations compare favourably with those in other countries, but there is some inconsistency between those prepared by COGLA and by CSA. Contrary to practice elsewhere, COGLA regulations do not permit surface decompression, and insufficient attention is paid to the need for training of life support technicians.

3. Operational procedures which involve hazards are (a) diving from a dynamically positioned vessel, (b) deep diving without a closed bell (c) use of SCUBA. All are addressed under the COGLA Diving Regulations (Draft) 1983.

4. Contingency plans prepared by diving companies should be scrutinized by regulatory agencies and updated regularly.

5. Communication links are vital between diver and surface, from inside to outside a chamber, to and from rig medic, company physican and shore base.

6. Diving accidents have occurred when operating from dynamically positioned vessels, from diving bells and as a result of loss of supply of air.

7. The diving team should be capable of rendering immediate First Aid. As the rig medic and diving supervisor cannot leave their stations, specially trained emergency medical technicans should undertake treatment in compression chambers.

8. Because of the absence of backup facilities, only conservative treatment should be attempted offshore. However, complex procedures may have to be undertaken by specialist physicians.

9. Transfer of a diver presents difficulties, especially in saturation diving. Evacuation may be required and effected by transferring part of the diving system to a support vessel, using a °fly-away° hyperbaric chamber, or by °hyperbaric lifeboat°.

10. Plans were outlined for an onshore hyperbaric facility in St. John°s.

11. Training diver medical technicians is difficult because they have no recognized status in Canada. The C.M.A. Emergency Medical Technician training with additional topics is considered as appropriate.

12. Life support technicians and diving supervisors require training in hyperbaric medicine for their routine duties and to deal with emergencies.

13. Medics and physicians should have special knowledge of diving medicine and safety.

14. Special training courses are required to train physicians to undertake examination of divers and to act as specialists in diving medicine.

15. In addition to diving skills and knowledge of diving medicine, the diver must possess a wide range of other skills.

16. Some control of the numbers and qualifications of divers and diving supervisors is required. Current regulations are compatible with high standards of training.

17. Research programs are required in improving emergency gas supply systems, the effects of toxicity, the comparative safety of various types of diving, compression sickness and the basic principles of thermal protection.

# REFERENCES


1. Canada Oil and Gas Diving Regulations (Draft), Canada Oil and Gas Lands Administration, Ottawa, 1983.

2. Zinkowski, N.B.; Commercial Oilfield Diving, Cornell Maritime Press, Cambridge, Maryland, 1982.

3. Oil and Gas Lands Administration, February 1983.

4. Ibid, "Surface Decompression", Section 0503.

5. Childs, C.M, Roberts, K., and Bleweth, P.R.: "Report and Comments on Matters Relating to Commercial Diving Offshore Canada", 1983.

6. Amoux, G; "Survival and Rescue of Manned Underwater Systems", Second Underwater Engineering Symposium of the Association of Offshore Diving Contractors, Aberdeen, March 1980.

7. Canada Oil and Gas Diving Regulations, Canada Oil and Gas Lands Administration, Ottawa, February 1983, Part IV, Section 24.5-.6, Section 26, 1-29, Section 41, 1-5.

8. Norwegian Petroleum Directorate, 1980: "The Principles of Safe Diving Practice 1975", CIRIA Underwater Engineering Group, Report UR2, Part 1, London, 1975.

9. Provisional Regulations For Diving on the Norwegian Continental Shelf, Norwegian Petroleum Directorate, 1980, Section 3.1, 3.1.1-3.1.4.

10. "Emergency Isolation of Gas Circuits in the Event of a Ruptured Bell Umbilical", Diving Safety Memorandum, No. 8/1982, U.K. Department of Energy Diving Inspectorate.

11. "Lost Bell Relocation", Diving Safety Memorandum, No. 9/1981, U.K. Department of Energy Diving Inspectorate.

12. "Diving Bell Buoyancy", Diving Safety Memorandum, No. 7/1980, U.K. Department of Energy Diving Inspectorate.

13. "Lost Diving Bell Emergency", Diving Safety Memorandum, No. 7/1980, U.K. Department of Energy Diving Inspectorate.

14. James, P.B.; "Safer Operation of Bell Diving System", Pressure 1979, 8(5); 1-7.

15. "Guidance Notes/Codes of Practice: Design and Operation of Diving Bells", Association of Offshore Diving Contractors, London, 1980.

16. International Underwater Contractors (Scotland) Ltd., "Emergency Diver Transfer System Now Operational in Aberdeen", (company specifications), presented to the course on Medical Emergencies in Commercial Diving given by the Norwegian Underwater Institute and the Institute of Environmental and Offshore Medicine of Aberdeen University, June 1980.

17. "Preliminary Analysis of Operating Conditions at the Hibernia I-46 and North Dana I-43 Locations, February 12-20, 1983", Newfoundland Petroleum Directorate, March 1983.

Chapter 13

# ONSHORE MEDICAL RESOURCES NEWFOUNDLAND AND LABRADOR

## 13.1 INTRODUCTION

The onshore medical resources include the company physician, the Medical Emergency Response Team and the provincial primary, secondary and tertiary facilities. The assistance available from these resources ranges from the provision of medical advice and consultation to hands on assistance and receipt of casualties.

## 13.2 LOCAL MEDICAL RESOURCES (OIL COMPANIES)

### 13.2.1 PHYSICIANS

The major oil companies and associated service companies operationally based in St John's have contracted local General Practitioners to provide pre-employment medical examinations, intercurrent onshore medical care, radio/telephone consultation with rig medics, and occasionally medical services on the rigs. These physicians function as independent contractors, and their contractual arrangements vary from company to company.

During 1983 group practices were developed to ensure that a physician would be available 24 hours a day and that a second physician could provide continuous interim advice to the medic if the physician were to proceed offshore. Each physician or medical group is responsible for identifying and providing the medical equipment which he may need on an offshore drilling unit in an emergency. The company provides the physician with the safety equipment required for helicopter travel over water at the airport.

As indicated in the Chapter 14 Emergency Contingency Planning, the company physician is responsible for deciding whether he is able to handle the medical emergency or whether the expertise of a medical emergency team is required. This decision is often made in consultation with the company's shore-based Emergency Operations Officer. If the MERT is not required, the company physician decides to which hospital the patient will be admitted taking into account the type of specialty service required.

### 13.2.2 MEDICAL EMERGENCY RESPONSE TEAM

A Medical Emergency Response Team is available from the Health Sciences Centre on a twenty-four hour basis to respond medical emergencies outside the hospital environment. The team is composed of a group of specially trained physicians, nurses and technical assistants, the physicians being anaesthetists, general surgeons and/or emergency physicians and the nurses having a wide range of experience in areas such as Coronary Care, Intensive Care or Emergency nursing.

At present, the membership of this team is decided on an ad hoc basis as the physicians are reluctant to commit themselves to such duties due to lack of medical malpractice insurance. As discussed in section 2.5 the Canadian Medical Protective Association insurance does not provide coverage for services or for advice/consultation provided beyond the 12 mile limit.

As of January 1, 1984, the Association of Registered Nurses of Newfoundland will no longer provide malpractice insurance for its members who are practicing outside the province.

Recently, inquiries revealed that medical malpractice insurance for the activities of physicians beyond the limit of the territorial sea is available at reasonable individual and group rates.

The physicians are also concerned about personal accidental death and dismemberment insurance. This type of insurance is typically available on an individual as opposed to a group basis due to the varying salaries, number of dependents, etc. of the members of the group. Varying values of dismemberment insurance would be required for different specialties. For example, the loss of a finger may devastate a surgeon's career yet a general practitioner may be able to carry on his practice. To date, this lack of accidental death and dismemberment insurance has not been resolved.

It is expected that, until the appropriate insurance coverage is arranged, membership of the medical emergency response team will continue to be determined on an ad hoc basis upon a request for aid.

At present, the Provincial Department of Health is negotiating with the Health Sciences Centre to establish an Emergency Response Team formally(1).

### 13.2.3 PROTOCOL FOR THE MEDICAL EMERGENCY RESPONSE TEAM

The role of the Medical Emergency Response Team in an offshore emergency is discussed in the section of Medical Emergency Contingency Plans. The protocol for activation of this team has been established satisfactorily by precedent.

Requests for the emergency team are directed to the emergency physician on duty in the Emergency Department at the Health Sciences Centre. This physician takes the clinical details and other relevant information, then contacts the Emergency Response Team leader. If the team leader decides to mobilize the team, it assembles in the Emergency Department. Equipment exclusively for team use, is kept in the Emergency Department (Refer to Appendix 13-A), including a monitor defibrillator, medical anti-shock trousers, airway equipment, intravenous fluids, bandages, splints, drugs, and other emergency supplies. This equipment is highly portable and allows the team to provide initial resuscitation under adverse conditions.

Transportation of the team, for either offshore or onshore emergencies, is arranged by the agency requesting assistance, or by the Department of Emergency Medicine through the Department of Health, Canadian Coast Guard, or Search and Rescue. If helicopter transport is to be used, the helicopter usually picks up the team at the Torbay Airport. A helipad at the Health Sciences Centre may

also be used.

When the Emergency Medical Response Team has been mobilized, medical control for the patient is assumed by the team leader who communicates with the appropriate personnel in the agency requesting the service. In dealing with a medical problem in the offshore petroleum industry, the appropriate personnel are the Company doctor, the Emergency Operations Officer, the installation manager and rig medic, or the captain of the standby vessel involved. The team proceeds to the emergency site, provides initial medical care and then returns the patient to a hospital designated by the team leader . For example, a worker with a head injury would by preference be transported to a hospital with a neurosurgical unit.

Casualties from offshore units operating on the Grand Banks have generally been brought to St. John's for treatment as it is the closest available hospital to Hibernia and the majority of the province's specialized medical services are available. The port of St. John's is also strategically located close to many trans-Atlantic shipping routes and is the major supply port for oil and fishing industries.

## 13.3 HOSPITAL RESOURCES IN ST. JOHN'S

The general and specialist services available in the hospitals in St. John's will be reviewed.

The three acute care hospitals in St. John's which can receive patients from offshore are the Health Sciences Centre, the Grace General Hospital and St. Clare's Mercy Hospital. Of the other two hospitals in St. John's, the Waterford Psychiatric Hospital would be expected to receive and treat those patients with acute psychiatric problems, The Janeway Children's Hospital would not be suitable as it is exclusively a paediatric hospital.

While their differences are discussed in Appendix 13-B, the three acute care institutions are very similar in size and in provision of specialty services. All have over 300 beds each and are capable of providing some degree of intensive critical care. Each institution has a Disaster Plan, and, in addition, a joint committee with representatives from all the St. John's hospitals is developing an integrated Hospital Disaster Plan. Finalization of this plan is desirable as it would be suitable for implementation in the event of a large scale marine emergency.

### 13.3.1 EMERGENCY DEPARTMENT

All three hospitals have a designated Emergency Department which is fully staffed twenty-four hours a day by both Registered Nurses and physicians. The Emergency Department is staffed by full-time emergency physicians on a 24 hour basis at the Health Sciences

Centre and the Grace General Hospital. St. Clare's Emergency Department is staffed by residents during the day and by emergency physicians during the night. The Emergency staff of each institution has available full consultative support, twenty-four hours a day. Each Emergency Department is capable of receiving, resuscitating or triaging large numbers of patients simultaneously.

13.3.2 RADIOLOGY

Each hospital has a Radiology Department capable of handling multiple patients, but they are not all equipped to handle the entire spectrum of radiographic investigation. The Grace Hospital and St. Clare's have limited neuroradiology capabilities. The Health Sciences Centre has the only CAT Scanner in the province. Invasive Vascular Radiology (angiography) is not available at St. Clare's. The Health Sciences Centre is the sole institution which has radiologic technologists in the X-Ray Department twenty-four hours a day.

13.3.3 LABORATORY

All three hospitals have comprehensive twenty-four hour a day Laboratory services, and each has a fully staffed blood banking service.

13.3.4 OPERATING ROOMS

The Operating Rooms in these hospitals are equipped to handle most surgical emergencies. However the Grace Hospital and St. Clare's are not equipped or staffed to perform neurosurgery or open heart surgery. Such operations are conducted at the Health Sciences Centre.

13.3.5 SPECIALTY UNITS

The following specialities are available in these hospitals:-

i. Well-equipped Intensive Care Coronary Care Units are available in all three hospitals.
ii. The only formal Neurosurgical/Neurological service, which handles the entire spectrum of neuro disease, including spinal cord injuries is at the Health Sciences Centre.
iii. There is a two-bed Burn Unit at the Health Sciences Centre. The Intensive Care Units at St. Clare's and at the Grace Hospital also manage burn patients.
iv. The only Ear, Nose and Throat in-patient service in St. John's is located at the Grace Hospital.
v. Obstetrical and Gynaecological services are available at both the Grace and St. Clare's.
vi. Cardiovascular Surgery requiring the use of Cardiac by-pass is performed at the Health Sciences Centre.

vii. Primary Ophthalmology is available at the Grace and St. Clare's, and tertiary level Ophthalmology is available at the Health Sciences Centre.

viii. Renal Dialysis services are based at the Health Sciences Centre and at the Grace Hospital. St. Clare's has an arrangement with the Grace Hospital to borrow dialysis equipment and the services of the dialysis team to perform renal dialysis at St. Clare's.

### 13.3.6 DISASTER PLAN

The Health Sciences Centre, the Grace General Hospital, and St. Clare's Mercy Hospital each have individual formal Disaster Plans using the services of their own personnel. There are accepted transfer protocols in place among the St. John's hospitals and other tertiary referral centres in Halifax, Toronto, Montreal and London, Ontario. The Disaster Plan for each hospital makes provision for an Emergency Disaster Response Team. However, as stated previously, only the Health Sciences Centre is currently developing a formal response team to meet onshore and offshore pre-hospital emergencies.

Each institution is capable of managing simultaneously five to ten critical patients (requiring immediate surgery), ten to thirty urgent patients (usually requiring intensive management), and fifty to one hundred non-urgent patients.

A coordinated disaster plan for St. John's is currently being developed by the St. John's Inter-hospital Disaster Committee. This plan will be an essential component of the onshore component for meeting large scale emergencies offshore.

### 13.3.7 AMBULANCE SERVICE

The provision of ambulance services in St. John's and in other parts of the province was discussed previously in Chapter 11 on Communications and Transportation. In this context the points to be emphasized are:

a. the need for modular type ambulances capable of providing life support

b. the training of all attendants to CMA Emergency Attendant I level

c. the provision of a second attendant in ambulances operating outside St. John's

d. the need for an inventory of vehicles from other agencies which are capable of being used for transporting patients on stretchers.

### 13.3.8 HELICOPTER LANDING FACILITIES

The Health Sciences Centre has a fully lighted, designated Helipad within one hundred yards of the Emergency Department. The Grace Hospital has a lighted, designated helicopter landing area immediately behind the hospital on its parking lot. In both instances patients are transferred from the helicopter to an ambulance and then driven to the Emergency Department. A designated heliport is also available at the Janeway Child Health Centre which would involve a period of 20 minutes transportation by road to the Health Sciences Centre, the Grace General Hospital, or St. Clare's Hospital. St. Clare's is not immediately accessible to helicopter traffic.

The major helicopter and fixed wing landing and servicing facility in the metropolitan area is Torbay Airport. Upon arrival at Torbay Airport, patients will be transferred by ground ambulance to the appropriate hospital. The time involved for ground travel from Torbay ranges from 10 minutes to the Health Sciences Centre to approximately 20 minutes to St. Clare's Mercy Hospital or the Grace Hospital.

### 13.4 **HYPERBARIC FACILITY - ST. JOHN'S**

There is a limited hyperbaric facility in St. John's at the Marine Sciences Research Laboratory, Logy Bay which is available on a charitable basis. This unit is not adjacent to a hospital thereby necessitating transport of blood samples and other tests to a hospital for analysis. This facility has several limitations: 1) it does not have a saturation capability, 2) the chamber is very small in size, thereby precluding any complex treatment, 3) it does not have a hand lock through which to pass supplies and, 4) there are no extra penetration points to allow leads to be used for monitoring the patient. As the facility is not a medical facility there is no provision for funding staff call back, nor for insurance. A committee established at the Health Sciences Centre, is planning an adequate hyperbaric centre.(Refer to section 11.8).

An adequate number of physicians specially trained in hyperbaric medicine is available. COGLA has recognized two physicians as diving specialists and two physicians are approved to examine divers and to provide treatment under the supervision of a specialist.

### 13.5 **OFFSHORE HEALTH CARE PERSONNEL FACILITIES**

The onshore medical personnel and facilities should be organized to interact with the personnel and facilities offshore, which have already been discussed in Chapters 7 and 8. In brief, drilling units operating on the Canadian East Coast must have a trained rig medic on board at all times, and who is supported by

crew members who have had first aid training. The medic operates and maintains a sick bay which is adequately supplied and equipped, can accommodate one to two patients, and is best located adjacent to an area which is large enough to be used for triage and resuscitation of casualties.

## 13.6 PATTERNS OF EVACUATION TO MEDICAL FACILITIES

All individuals evacuated for medical reasons from the rigs operating in the Hibernia field have been brought to a St. John's medical facility.

For offshore drilling units operating in the Labrador Sea, in the event of a serious injury or illness requiring a medical evacuation of the worker, it is likely that Goose Bay will be the secondary care base. Alternatively, St. Anthony has a similar medical facility. Gander has substantial emergency resources, a major contingency plan and is the provincial base for Search and Rescue helicopters. The established practice for the evacuation of seriously injured personnel from the drill units operating in the Labrador Sea is to transport them to Goose Bay for stabilization and then to transport the patient to a major facility on the Island.

## 13.7 ONSHORE MEDICAL RESOURCES, NEWFOUNDLAND AND LABRADOR EXCLUDING ST. JOHN'S

Medical facilities in the Province may be divided into service regions based on proximity to the maritime environment. The South East and East Coast regions can be related to facilities in St. John's. For the remainder of the Province the division can be made as follows:-

i. West Coast ........................ Corner Brook
ii. Air/Sea Rescue coordination ....... Gander
iii. North East and North West Coast ... St. Anthony
iv. Labrador .......................... Goose Bay
v. Labrador Coast .................... Stephenville
vi. South West Coast .................. Stephenville
vii. South Coast ....................... Burin

### 13.7.1 CORNER BROOK (WEST COAST)

Western Memorial Hospital is a 279 bed acute care facility which has medical, surgical and critical care facilities. There are forty-six physicians on staff. The Emergency Department is open twenty-four hours a day and has twenty-one examining spaces. It is staffed full-time by Registered Nurses and a physician is always available in-house. The operating room is equipped to handle all surgical emergencies, but does not have facilities to deal with complex neurosurgical or open heart (bypass) cases. The

X-ray Department is comprehensive with the exception of CAT scanning capability. The Laboratory is capable of handling routine work and there is an in-house blood bank.

The hospital has a lighted helipad, and there are five ambulances available for patient transport. The nearest airport for fixed wing aircraft is thirty miles from the hospital at Deer Lake. The hospital is capable of handling six to ten critical patients, twenty urgent patients and up to fifty non-urgent patients simultaneously. There is a formal Disaster Plan but there is no official designated pre-hospital Emergency Response Team.

13.7.2 GANDER (CENTRAL, AIR/SEA RESCUE COORDINATION)

The James Paton Memorial Hospital is a full service general hospital with 162 acute beds, and separate Medical, Surgical and Intensive Care services. There are twenty-six physicians on the Medical Staff with sub-speciality representation. The Emergency Department is staffed by Registered Nurses and general practitioners twenty-four hours a day, with appropriate medical specialty backup.

The operating room can handle most surgical emergencies with the exception of complex neurosurgical or open heart cases. Radiological service is comprehensive but does not provide CAT scanning and arteriography services. The Laboratory is comprehensive and there is a twenty-four hour a day blood bank.

While the hospital does not have a formal helipad it is close to the Gander International Airport. There are twelve ambulances available in the immediate service area and there is a formal Disaster Plan. Where a single physician is required for a pre-hospital emergency, the physician on duty in the Emergency Department responds. This arrangement might produce conflicting roles in a large scale disaster. The hospital also acts as a training base for Canadian Armed Forces' Search and Rescue medical technicians, who are consigned to the Canadian Armed Forces 103 Seach and Rescue Squadron which is stationed in Gander.

13.7.3 ST. ANTHONY (NORTH EAST AND NORTH WEST COASTS, SECONDARILY LABRADOR)

The health resources of Labrador (excluding Labrador City) and the Northern Peninsula are the responsibility of the Grenfell Regional Health Board with administrative centre located in St. Anthony.

St. Anthony has a 149 bed acute care facility with medical, surgical and critical care capabilities. Thee are fourteen physicians on the Medical Staff. The Emergency Department is staffed by Registered Nurses from 0800-2400 hours, and a physician is available inhouse. There are two operating theatres which are general purpose, but lack neurosurgical or open heart

capabilities.

The X-ray Department can perform routine radiographic procedures and arteriography but does not have CAT scanning capacity. The Laboratory is capable of performing standard tests and there is a twenty-four hour a day blood bank.

The medical staff provides pre-hospital emergency response to the Labrador Coast and Northern Newfoundland. There is an unlit designated helicopter landing area next to the hospital. A local airfield accepts only small fixed winged craft.

13.7.4 GOOSE BAY (LABRADOR)

There is a 40 bed acute care hospital at Goose Bay with backup facilities at the Canadian Forces Base, Goose Bay. The hospital has one operating room and one x-ray room, which does not have the capacity for angiography or neuroradiological proceedings. The Laboratory can perform routine tests but the blood bank capacity is limited.

The Medical Staff consists of one general surgeon, one anaesthetist, and seven general practitioners. The Emergency Room is part of the Outpatients Department and is staffed by Registered Nurses twenty-four hours a day. There is a physician inhouse twenty-four hours a day.

The Medical Staff is accustomed to responding to pre-hospital emergencies and there is a backup medical team available from the local Canadian Forces Base. The hospital has a formal Disaster Plan, and makes use of backup medical resources from St. Anthony. In evacuations from the offshore the hospital has been used for resuscitation prior to transport to a major medical facility. There is an unlit helipad next to the hospital and one local ambulance.

13.7.5 STEPHENVILLE (SOUTH WEST COAST)

There is an 80 bed acute care hospital in Stephenville, with medical, surgical and critical care capabilities. There are two operating theatres which are only suitable for basic surgery. Radiology has three x-ray units, but cannot perform CAT scanning or angiography. The Laboratory can perform routine tests, and there is a twenty-four hour a day blood bank.

The Emergency Room is combined with the Outpatients Department and is staffed twenty-four hours a day by Registered Nurses. There is a physician inhouse twenty-four hours a day.

There are eighteen physicians on staff, but very little subspecialty backup on site. There is a designated helicopter landing area near the hospital, and there is a major airport at

Stephenville. There are five ambulances available in the service area and the hospital has a formal Disaster Plan. The physician on call is expected to respond to pre-hospital emergencies but there is no formal second physician on-call system.

13.7.6 BURIN (SOUTH COAST)

There is a 31 bed Cottage Hospital in Burin, with limited critical care capabilities. There are six physicians on staff including one G.P. surgeon, one G.P. anaesthetist, and four general practitioners. Seriously ill or injured patients are usually transferred to St. John's. There is a single operating room which is capable of basic surgery only, and two X-ray units without neuroradiology or angiography capability.

The Laboratory performs only basic tests and there is no blood bank. Emergency cases are assessed in the Outpatient Department which is staffed only until 1700 hours Monday to Friday. There is no physician in-house. There is a designated, unlighted helicopter landing area in an open lot next to the hospital and the nearest airport is a limited landing facility, twelve miles distant at Winterland. The hospital does not have a formal Disaster Plan. There is a Canadian Coast Guard Life Boat Station at Burin, and in conjuction with this service physicians from Burin Cottage Hospital have been expected to provide pre-hospital maritime medical response

13.8 **ONSHORE MEDICAL RESOURCES - NOVA SCOTIA**

For comparison the services available in Nova Scotia are discussed briefly.

13.8.1 LOCAL MEDICAL RESOURCES (OIL COMPANIES)

The structure of the private medical services contracted by the oil companies based in Halifax are similar to those in St. John's. There has been a trend toward group practice by the physicians providing medical services to the drilling units operating in the Venture field.

13.8.2 MEDICAL RESOURCES IN HALIFAX

Halifax is the major medical centre for Nova Scotia, and as the closest major centre it receives medical evacuations from the Venture field. There are three tertiary care facilities in Halifax and all specialty and subspecialty services are available(3).

13.8.3 MEDICAL RESOURCES IN CAPE BRETON

Hospital facilities are also available in industrial Cape Breton where most of the major specialties are represented with the exception of a burn unit, neurosurgery and cardiovascular

surgery(3). These facilities may be used if weather conditions render Halifax inaccessible to air traffic. If the petroleum exploration expands further into the Gulf of St. Lawrence the medical facilities at Cape Breton may begin to receive casualties from the offshore more frequently.

#### 13.8.4 HELICOPTER LANDING FACILITIES

Unfortunately, the hospitals in Halifax do not have an adjacent helipad. In the past, the helicopter had to land at the Halifax Airport which is at best a thirty-minute ambulance drive from metropolitan Halifax. This problem has been resolved as the Port Authority has indicated that its helipad can be used for medical emergency purposes(2). Consequently, transport time by ambulance has been significantly reduced.

### 13.9 HYPERBARIC FACILITIES - HALIFAX

At present there is no saturation diving being carried out on the Scotian Shelf. The amount of air diving activity varies from rig to rig. Portable recompression chambers are available on the rigs when diving activities are carried out. The commercial diving companies in Halifax maintain backup hyperbaric facilities. In addition, the Armed Forces Fleet Diving Unit (Atlantic) which is located in the Halifax area is available for emergencies. There is no hyperbaric facility in the area capable of supporting divers in the saturation mode(4).

The hyperbaric medicine facilities in Halifax are being upgraded. A proposed new diving school based in Halifax with facilities designed for training, will permit use for clinical medicine and for research. This facility has the advantage of not being dependent on the resources of commercial diving the availability of which might vary from day to day.

There is a sufficient number of physicians trained in hyperbaric medicine in Halifax. COGLA has recognized one physician as a diving specialist, and one physician to examine divers and to provide treatment under the supervision of a specialist.

### 13.10 PUBLIC HEALTH

Public health professionals play a major role in the prevention of disease and public health resources in the provinces of Newfoundland and Nova Scotia are needed not only to respond to a major epidemic in the offshore but to provide certain other basic services as they do onshore. Public health physicians should be involved at all levels of offshore operation to ensure that the interests of workers, industry, and government are served by a cooperative approach depending upon close collaboration between the appropriate Federal and Provincial Government departments.

A small number of public health physicians should be trained in offshore health care. Since there will be some overlap between public health professionals and those working in the Department of Labour and Workers' Compensation Boards, these groups should cooperate with each other.

## 13.11 SUMMARY

1. Physicians provide services under contract to companies either individually or in groups.

2. The company physician decides on the method of handling an emergency and the type of assistance required.

3. The Medical Emergency Response Team is currently available on an ad hoc basis and arrangements are being made to institute it on a formal basis.

4. The protocol for mobilizing this Emergency Response Team is described.

5. The facilities available in hospitals in St. John's and in other areas of the province are described in detail.

6. Ambulance services should be improved by the provision of a modular vehicle with life support and by ensuring the level of training of all ambulance drivers.

7. The hyperbaric facilities in St. John's are not suitable for medical purposes.

8. The pattern of evacuation from various offshore sites to areas of the province is given.

9. For comparison, the situation in Nova Scotia is described.

10. Some public health physicians should be trained in offshore health. Public Health physicians should be involved at levels of offshore operations.

## 13.12 CONCLUSIONS

### 13.12.1 HOSPITALS IN NEWFOUNDLAND AND LABRADOR

1. The General Hospital, Health Sciences Centre, should be designated as the Medical Control Base for pre-hospital emergency medical response for the Hibernia Oil Field.

2. The St. John's Inter-hospital Disaster Committee should complete the development of a coordinated Hospital Disaster Plan.

3. Provision should be made for the necessary equipment and training of medical personnel to allow optimal response to pre-hospital emergencies (Refer to Appendix 13-A).

4. There should be a formal categorization of the emergency capabilities of the three St. John's hospitals which would be involved in response to the offshore environment, to include a definition of the types (severity and diagnosis) and numbers of patients each should receive in any disaster situation.

5. One centre should be designated to facilitate the overall emergency medical response within the Province.

6. Strategically located medical facilities in Goose Bay, St. Anthony, Gander, Corner Brook, Stephenville and Burin should be identified as first line emergency response resources. However, the types of patients to be transferred to these hospitals must be categorized in advance, according to the available resources of each hospital.

7. Funding should be made available to purchase medical response equipment and to provide training for medical personnel.

8. Consideration should be given to further development of the existing integrated medical communications network connecting the designated centres. This should be accessible to all agencies involved in disaster management.

### 13.11.3 DISASTER PLANS

All communities should have an integrated disaster plan.

## REFERENCES


1. Minutes of Second Meeting to Consider Emergency and Urgent Offhsore Medical Response Capacity, Centre for Offshore and Remote Medicine, Memorial University of Newfoundland, March 1983, p. 3.

2. Ibid, p. 4.

3. Holland, J; "Preliminary Summary of Scotian Shelf Operations", Report Prepared for the Occupational Health and Safety Study, Centre for Offshore and Remote Medicine, Memorial University of Newfoundland, December 1982, p. 2.

4. Ibid, p. 4.

## BIBLIOGRAPHY

1. Colohan, D.; "Emergency Medical Response to the Offshore Environment", Related Papers of the Occupational Health and Safety Study, Centre for Offshore and Remote Medicine, Memorial University of Newfoundland, June 1983.

Chapter 14

MEDICAL EMERGENCY CONTINGENCY PLANNING

## 14.1 INTRODUCTION

Most health problems which occur offshore are apt to be of a minor nature and can be managed by the rig medic with or without advice from the shore-based company doctor. Infrequently emergencies arise and may involve a wide range of trauma including fractures, lacerations, amputations and head injuries; acute medical emergencies such as heart attacks, brain haemorrhage, pneumonia and other infections; problems associated with exposure, drowning, hypothermia, and acute medical complications of diving. These emergencies may occur on a mobile drilling unit, on a standby or service vessel, or on a helicopter. When an emergency occurs ( where there is threat to life and/or limb) there must be a contingency plan in place to ensure that the patient is provided with the best care at every stage of management, from initial first aid to eventual treatment in an onshore facility such as an intensive care unit.

## 14.2 CONTINGENCY PLANS

Contingency plans for offshore emergencies are required by various regulatory agencies worldwide, and virtually all operating companies have some form of plan. A review shows that these plans vary from government to government, from jurisdiction to jurisdiction, from company to company, and even from rig to rig. The variations are often determined by the nature of the operation, the organizational structure of the company, the available health resources and transportation systems, and the regulations that are in force in a given area.

In eastern Canada contingency plans are required of all companies by COGLA and in Newfoundland by the NLPD, as part of the processes of approval of a drilling program. The plans of both these agencies have similar requirements. COGLA's regulations, as set out in Article 79(1) of the Application for Approval to Drill, require the licensee to develop a plan:

"79(1).....to cope with any foreseeable emergency situation during a drilling program, including

a) a serious injury to or the death of any person;
b) a major fire;
c) the loss of or damage to support craft;
d) the loss of or disablement of a drilling unit or a drilling rig;
e) the loss of well control;
f) arrangements for the drilling of a relief well should such become necessary;
g) hazards unique to the site of the drilling operation; and
h) spills of oil or other pollutants".

There is no mention of serious illness but it is assumed this could be covered in 79(1)(a).

The present Health and Safety Study is primarily interested in contingency planning for injuries and illnesses in which there is a threat to life and/or limb.

Human safety and health care are usually acknowledged to be the first priority in any emergency or disaster. However, the contingency plan should set out the provisions for health matters without jeopardizing general safety. Thus rig personnel should not be allocated competing responsibilities. For example, the rig medic should not be the only backup radio operator and advanced first aid personnel should not have primary fire fighting responsibilities in an emergency.

Contingency plans should follow normal procedures as far as possible and directions should be comprehensive but expressed clearly stated.

## 14.3 TYPES OF CONTINGENCY PLAN

Two levels of response can be envisaged in contingency plans. At the first level the emergency can be adequately handled by the operating company with or without limited involvement by outside agencies. At the second level successful resolution of the emergency demands resources external to the company.

### 12.3.1 EMERGENCIES REQUIRING COMPANY RESOURCES ONLY

The majority of emergencies will be handled by the operator using the company's own resources, and apart from the required reporting to regulatory agencies, no external contact will be necessary. To deal with medical emergencies at this level a number of personnel and resources on the installation may be involved.

As noted in Chapter 9, First Aid Training for Offshore Workers, a fellow worker will often provide the important first response to a victim of illness or injury. This help will be of high quality if the fellow worker has received proper first aid training. The rig medic, as the only health professional on most rigs will give medical care and stabilize the patient in preparation for management, either independently or in consultation with the company physician. Where possible medic and physician should be able to communicate directly with each other rather than through a third party.

A deficiency often noted in contingency plans is a failure to delineate clearly the roles and relationships of rig medics and company physicians. These individuals play a key role in emergency care and it is imperative to avoid ambiguity or uncertainty in the relationships of health personnel with each other and with administrators offshore and onshore.

Generally, in dealing with a medical problem the medic will decide on a course of action and may or may not consult the company doctor. However, in an emergency he should seek consultation if possible. A decision to have the company physician proceed offshore should be made jointly by the physician, the medic, and the offshore drilling supervisor, taking a number of factors into account.

It may prove valuable for the patient to be stabilized on the rig for a period of time rather than have the physician to respond immediately to a call to travel offshore without having fully assessed the situation. Helicopter crews and health personnel can put their lives in jeopardy because of the physician's precipitous response to a call from offshore. With adequate lines of communication time is usually available to delineate problems and to carefully determine whether or not the services offshore of the physician can meet the needs of the emergency or whether other health personnel could substitute, or accompany him, taking the necessary equipment and supplies. Prior consultation between the various individuals likely to be concerned will improve the quality of an emergency response.

Before the company physician goes offshore he should arrange for backup medical advice and consultation to be available to the medic and the installation manager during his period of travel to the rig. The plan should allow for the backup physician to contact additional help, if necessary. The onshore emergency centre should be alerted and given as much information as possible both initially and with regular updates in the event that evacuation eventually becomes necessary.

The nature of the illness or injury will usually determine the hospital to which the patient will be transported and admitted. As described previously, patients from the Hibernia area will generally be taken to The General Hospital in St. John's which has been designated by the Department of Health as the Provincial Emergency and Trauma Centre. Patients from the Scotian Shelf area will usually go to the Victoria General Hospital in Halifax. Patients from the Labrador Sea will be taken to Goose Bay or St. Anthony and if necessary, will be sent on to St. John's. Because of uncertain weather conditions alternate centres should always be designated and alerted.

A simple emergency may escalate to a major emergency and additional services and transportation may be required. Regulatory agencies and other emergency services should be alerted and kept informed of developments in the emergency.

### 14.3.2 EMERGENCIES REQUIRING THE FACILITIES OF EXTERNAL AGENCIES

If the resources of the company are not sufficient to cope with the emergency other resources will be required. The request may

be for specialized help such as airlifting a casualty from a supply vessel or in a major incident assistance may be required from a number of agencies. The resources available to provide such assistance include:

a) Canada Oil and Gas Lands Administration
b) Newfoundland and Labrador Petroleum Directorate
c) The regulatory agencies
d) The Canadian Coast Guard
e) The Department of National Defence (Search and Rescue)
f) Emergency Measures
g) Police Forces
h) Hospital Emergency Departments
i) Hospital in patient services
j) Emergency Medical Response Teams
k) Department of Health Resources
l) Other Provincial Government Departments.

The flowchart presented in Appendix 14-A represents the interpretation by the Study group of the current offshore medical emergency response organization. At the time of writing there is no document available to all the agencies who may be potentially involved in an emergency which depicts the responsibilities in this manner.

From this flowchart it can be seen that company resources can be utilized to deal with a given emergency without the necessity of mobilizing resources of the regulatory agencies. The services of Canadian Search and Rescue may be requested through the Canadian Coast Guard and this may be the only resource needed outside of the company. Both the Canadian Coast Guard and Search and Rescue have indicated that direct calls for assistance from oil companies could be responded to without a disaster having been offically identified(4).

If the emergency is considered to be a "significant event", immediate notification of the regulatory agencies is required even when limited numbers are injured (1). The company will state that the emergency procedures are being implemented according to the approved contingency plan and that a successful outcome can be anticipated.

A given accident may be upgraded to an emergency at any time and there may be a need to escalate a given incident from one manageable by the company resources to one requiring major support from one or more of the agencies listed above. The degree of seriousness of an illness or injury should be specified and a clear statement made of whether a major response is needed or whether a simpler and equally effective course of action will suffice. The escalation of an event from one level to a more serious level should be easily achieved with adequate communications channels.

An offshore disaster, defined as a situation "involving more than five injured persons and others still at risk" (2), would probably be beyond a company's resources. In such an event the medic should be in immediate communication both with the company physician and with other health resources, and the advanced First Aid team on the rig would be mobilized to provide assistance in triage and stabilization (Refer to the section 9.3 - "Advanced First Aid Team"). Where there are multiple casualties in an area with a number of rigs health personnel could be transferred to the disaster site. As operations increase on the Canadian East Coast it is likely that this option will become possible. Because a major disaster, by definition, involves not only a number of injuries but also a risk to others on board, the rig itself may be in jeopardy. The alternative would be to transfer casualties and health personnel to another rig while awaiting help from onshore.

a. Communications

The topic of communication has been covered in more detail in the section of this report on Communications and Transportation in Chapter 10. It is essential that in an emergency or disaster, reliable communications links be established and maintained between the medic, the company physician, and the manager offshore as well as the company's representative onshore. In an emergency the physician should proceed to the company's local office where he will have access to all the information which will assist him in his decision making. The physician is the most appropriate person to alert the hospital and the emergency response team if required.

While emphasizing that the medic and the company physician play a major role in decision making it is recognized that at times the health care of one or more workers may have to take second place to the management of an emergency that may be jeopardizing the whole rig and threatening the crew. Furthermore, the organization of the rescue efforts is the responsibility of the offshore and onshore managers. These individuals should be in communication with other agencies such as those who provide coordination of transportation resources, a vital part of any emergency medical response. Canadian Search and Rescue would be expected to coordinate transportation offshore and land transportation would be coordinated by the police forces.

## 14.4 REGULATORY AGENCIES' CONTINGENCY PLANS FOR PERSONAL INJURY OR FATALITY

The following is a brief review of the various contingency plans. The NLPD "Accidental Occurrences Contingency Plan Concerning Offshore Petroleum Related Activities" (draft) and the COGLA "Emergency Response Plan" (draft) recognize the ability of the

operator to deal with the majority of offshore medical emergencies utilizing only the resources of the company.

Active coordination by the regulatory agencies would occur in the "rare event" or second level emergency when the operator's resources are insufficient to cope with the emergency and the resources of various government agencies are required.

14.4.1 NEWFOUNDLAND AND LABRADOR ACCIDENTAL OCCURRENCES CONTINGENCY PLAN CONCERNING OFFSHORE PETROLEUM-RELATED ACTIVITIES, (DRAFT JANUARY 1983

Briefly, the NLPD contingency plan for personal injury or fatality envisages three progressive levels of interaction in the emergency procedures after initial notification by the operator:

i. monitors the situation.

ii. notifies Emergency Measures which establishes a communication link with Canadian Coast Guard and notifies General Hospital (MERT).

iii. same as ii above but Emergency Measures request the assistance of police, etc., and sets up an Emergency Operations Centre at the NLPD offices.

It is implied in the contingency plan that NLPD will assume the role of coordinator of other provincial government departments/agencies such as Emergency Measures, Department of Health, General Hospital as well as Federal agencies such as Canadian Coast Guard and Search and Rescue.

From enquiries conducted as part of this present study, it was confirmed that the NLPD contingency plan envisaged this agency as coordinating these resources. However, the Coast Guard and the Search and Rescue group of the Department of National Defence did not express agreement with NLPD's interpretation of its role (3,4). There is, therefore, major need for clarification of the roles of these various federal and provincial agencies and it is understood that they are now addressing this matter.

The NLPD plan recognizes that in any of the events for which they require contingency plans to be drawn up there is a great potential for personal injury and fatalities. Consequently, the notification detailed in the personal injury and fatalities section is integrated with the procedures established for other events. The exception is the blowout of a well where the Medical Emergency Response Team of The General Hospital (MERT) is not specifically mentioned for notification.

14.4.2 COGLA EMERGENCY RESPONSE PLAN (DRAFT FEBRUARY 1983)

COGLA's contingency plan for dealing with events involving personal injuries or fatality does not identify specific procedures to be followed. It provides for 3 orders (levels) of response:

first order - monitoring industry operators

second order - used only for environmental protection or restoration operations

third order - intervention in the management of operations other than environmental protection/restoration

This third level is to be effected "where it becomes apparent that appropriate action is not being taken to reduce or to mitigate any danger to life, health, property or environment resulting from a spill." (5). The requirement for this third order response is considered to be very unlikely.

The plan states that "provincial and territorial governments have the expertise and jurisdiction concerning...medical services. COGLA will develop regional emergency response plans which will describe the responsibilities and resources of these agencies in greater detail." (6). To date, a regional emergency response plan specific to the Newfoundland and Labrador drilling operations has not been prepared.

In summary, the COGLA Emergency Response Plan does not provide a single protocol for emergency responses involving possible injury or loss of life. It emphasizes the resolution of environmental rather than medical emergencies occurring in the offshore. The plan allows for coordination with SAR but not for contact with provincial resources such as EM, MERT, provincial hospitals, Department of Labour and Manpower, and Department of Health.

COGLA in effect delegates the responsibility for the provision of health care of offshore workers in emergency situations to the provincial agencies. Because of the jurisdictional dispute between the Federal and Provincial governments, ambiguities exist in the relations between the regulatory agencies.

## 14.5 THE ROLE OF FEDERAL AND PROVINCIAL GOVERNMENT DEPARTMENTS IN OFFSHORE EMERGENCIES

The role of the regulatory agencies in an emergency is to coordinate resources from other agencies. These resources include Federal and Provincial agencies, which are discussed separately.

### 14.5.1 FEDERAL DEPARTMENTS

a) Department of National Defence

"...The Canadian Forces have overall responsibility for the coordination of search and rescue in Canada, including the marine element off the coasts. This responsibility has been delegated to the officers of military commands who maintain rescue coordination centres in Halifax, Trenton, Edmonton and Victoria. For marine search and rescue, the available resources of all government departments operating vessels and aircraft (RCMP, DFO, DOT) are employed." (7).

b) Canadian Coast Guard - Search and Rescue

"The CCG fulfills a special role in support of maritime search and rescue operations under the coordination of the Department of National Defence. The CCG operates a fleet of rescue cutters and lifeboats in addition to its normal complement of busy tenders, icebreakers and helicopters. These resources, and a system of coast radio stations, constitute the backbone of the marine component of offshore SAR. In Halifax, CCG watchkeepers are assigned to the RCC to act as immediate marine advisors to the SAR comptroller. In St. John's the CCG operates a substation for SAR purposes." (8).

"The common practice of mariners reporting personal injuries or requesting medical assistance is to pass such information via the nearest Coast Guard Radio Station to the proper authority (in this case either RCC Halifax or MRSC St. John's). In their operational procedures, Search and Rescue officials, through the Department of National Defence and the Canadian Coast Guard coordinate the degree of response required. This could be the deployment of a helicopter to evacuate the injured person(s), the provision of medical advice to ship's personnel, or bringing medical supplies and/or medical personnel to the site." (9).

As described previously, the services of the CCG-SAR can be requested in an emergency involving an offshore drilling unit by COGLA, Emergency Measures or NLPD, or directly by the company.

14.5.2 PROVINCIAL DEPARTMENTS

The NLPD "Contingency Plan for Accidental Occurrences in Offshore Petroleum Activities" defines the responsibilities of the various Provincial departments and agencies during or post-emergency procedures. In summary these responsibilities cover:

a) Emergency Measures

Emergency Measures operates within the Department of Justice and has a responsiblity to "coordinate all emergency resources in situations where risk to human life is involved" (10). In the offshore situation EM discharges this responsibilty in cooperation with NLPD. On being notified by NLPD of any request for aid arising from an offshore accident, EM coordinates mobilization of

emergency services with the operator and/or CCG. It also acts as an advisor to NLPD on the availability of provincial emergency resources.

b) Department of Health - Hospital Services

The Department of Health is identified by NLPD as being responsible for providing "emergency medical services at a hospital and at the site when required through Emergency Medical Response Team," (11) and will "liaise with Petroleum Directorate and EM regarding requirements for emergency medical services." (12). After the resolution of the emergency the Department of Health will report to the Newfoundland Petroleum Directorate indicating the adequacy of the medical response provided for the emergency, available services and response capability.

The Newfoundland and Labrador Department of Health, through a reorganization of the emergency health and ambulance services, established a Division of Emergency Health and Special Services which is responsible for emergency and hospital disaster planning, and for the coordination of disaster planning for public health and hospital personnel (13). This division will also coordinate emergency medical response and the operation of the provincial air and road ambulance program. This is probably the division of the Department of Health most suited to playing a role in emergency response plans.

The Health Services section in the NLPD Contingency plan has been changed to read "The General Hospital" which recently has been officially designated by the Department of Health as the Provincial Emergency and Trauma Centre. The General Hospital Emergency Department staff, including several doctors with experience in offshore medicine, are available on a 24-hour basis. The General Hospital and the Department of Health have had discussions regarding the resources, equipment, training and funding needed for the establishment of a mobile medical emergency response team which would be used for onshore as well as offshore emergencies. The General Hospital has indicated that the resources for a Medical Emergency Response Team are available but such a team has not been formally been constituted. It is expected that this will occur shortly as certain problems, including arrangements for personal accident and malpractice insurance appear to be in process of being resolved (14).

c) Department of Labour and Manpower

The Department of Labour and Manpower is responsible for the implementation of the Occupational Health and Safety regulations under the Petroleum Drilling Regulations, 1982, pursuant to the Petroleum and Natural Gas Act. The Department of Labour and Manpower, Occupational Health and Safety Division has 2 or 3 inspectors who inspect the working conditions on the drilling

units every three weeks. The inspection report sheet, covers such aspects as the condition of gas masks, employees wearing hard hats and protective clothing, eyewash stations, etc. The Division also monitors the minutes of the Occupational Health and Safety Committee on each rig to ensure that the company takes appropriate actions on the suggestions of the Committee.

d) Workers' Compensation Board

The Workers' Compensation Board is involved in the post-emergency reporting procedures. If an accident occurs offshore or a person is afflicted with an occupational illness which results in lost time, these must be reported to the WCB. A medical examination of the patient is conducted and the claim processed based on the outcome of the examination and the period of disability.

## 14.6 COGLA GUIDELINES FOR EMERGENCY CONTINGENCY PLANS

COGLA's published "Guidelines for Emergency Contingency Plans" suggest the format and content for the contingency plans for operators who undertake drilling in Canada. The operator's plans must mesh with those of the contractors' and subcontractors'.

Section 3.0 of these Guidelines concerning serious injury or death indicates that the submitted plan should outline the responsibilities of key personnel onshore and offshore pertaining to:

i) provision of first aid at drill site;

ii) communication to shore base

iii) primary means of evacuation;

iv) secondary means of evacuation in the event of foul weather or other factors precluding use of primary evacuation;

v) preparation for hospital admission;

vi) notification of next of kin, Workers' Compensation, and documentation of events;

vii) statement indicating compliance with item 35 of Canada Oil and Gas Drilling Regulations which requires the operator to make arrangements for

   (1) a qualified physician to be available for consultation or transport to the drilling unit on a 24 hour basis,
   (2) an injured person to be speedily transported to a hospital and
   (3) the minimum qualification for the sick bay attendant is a valid certificate of medical training for a provincial

industrial first aid course. This attendant must be available on the rig at all times.

## 14.7 CONTINGENCY PLANS SUBMITTED BY PETROLEUM OPERATORS

The roles of the regulatory agencies and the resources available to them have been discussed. Contingency plans, submitted to COGLA and NLPD by companies operating in the Newfoundland offshore, have been made available to this Study for review.

In general, it was noted that while the key personnel involved in an emergency resulting in serious injuries are the medic and the company physician, their responsibilities and duties are not set out in these contingency plans.

For example, it is stated in some of these plans that the medic must "request" permission for a medical evacuation from the drilling superintendent. While this may be in order if the decision is administrative , the medical decision should be taken, where possible, by the medic in consultation with the company physician. This is one reason why the rig medic should be in continuous contact with the supervising company physician or hospital emergency department whenever there is a medical emergency.

The following specific comments are offered on contingency plans submitted by three oil companies operating in Atlantic Canada.

### 14.7.1 COMPANY No. 1

This plan does not outline the role of the medic. If it is decided that an evacuation is necessary it can be assumed that the drilling supervisor is advised of this by the medic, but this is not set out. The medic's duty during an emergency should be outlined in detail and the relationship between the medic, the drilling supervisor and the company physician should be clarified. The plan indicates that the company physician is only contacted by the drilling superintendent (shore based) if the injured person is an employee of the operator. Furthermore, the physician is to be contacted only after the decision to evacuate has been made. The company physician should have been contacted by the drilling supervisor or the medic at an earlier stage in the management of such a problem. Precipitous evacuation will not necessarily be in the best interest of the patient.

If the injured person is not an employee of the operator the plan calls for the contractor's onshore manager to be notified rather than the operator's company physician. The contractor's manager then is responsible for arranging hospital admission and for meeting the helicopter. It is not indicated in the plan whether a physician is or is not retained by the contractor to provide advice and assistance to the medic. Arrangements as outlined in

this plan could lead to considerable confusion during an emergency. It would be confusing, if not impossible, for the medic to relate to more than one physician.

In a practical sense, the first physician contacted would almost always have to assume the responsibility for giving advice regarding all the patients. As stated elsewhere, the company's medical director should be responsible for all health care on the rig and should delegate this responsibility to one physician only with appropriate backup by one or more colleagues. The company physician should know the medic's qualifications and abilities, and should be in continual contact with the rig medic on health matters.

### 14.7.2 COMPANY No. 2

As with Company No.1 the roles of the medic and the company physician are not specified in the contingency plan and this major deficiency needs to be corrected with the roles of these key personnel set out clearly. In the plan, the decision as to whether the company physician is to proceed offshore is made by the Area Drilling Superintendent/Drilling Supervisor and the rig manager. It can only be inferred, from reading this plan, that the company physician and the medic are involved in the decision, but their involvement is not stated. Again, there is no indication that the local company physician is contacted before the Area Drilling Superintendent and the rig manager decide that a physician is needed to go offshore. The possible needs for consultation with the hospital or activation of the Medical Emergency Response Team are not considered.

There is no provision in the plan for reception at a shore-based airport or hospital heliport, nor provision for ground transportation nor notification of the hospital of the pending arrival of the patient. These major deficiencies point to the need for input from company physicians in developing contingency plans and for seeking medical opinion before a plan is approved.

### 14.7.3 COMPANY No. 3

This contingency plan was developed within the last 12-18 months and has few of the major deficiencies found in the previous two. The relationships between the rig medic and the company physician and their relationships with the offshore and onshore administrative personnel are clearly set out. There is clear evidence of communication between the medical department and the operations side of the company in developing this acceptable contingency plan.

Although some flexibility can be allowed to accommodate the particular characteristics of some rigs, there should be common features in each contingency plan. Active involvement of health

and safety professionals from industry and other agencies will do much to ensure development of contingency plans that are reasonable, practical and acceptable to industry as well as to the regulatory agencies.

## 14.8 THE NEED FOR COORDINATED PLANNING

A number of meetings of those involved in offshore emergency health services were held during late 1982 and 1983 and led to a consensus as to the general procedures and practices that should be followed(3,4). The flowchart presented earlier in this section reflects the agreements reached (Refer to Appendix 12-A). Despite these advances, there are still some uncertainties regarding the exact roles of a number of agencies.

Thus, it cannot be claimed with confidence that a finely tuned emergency plan exists in St. John's at the time of writing of this report. To allow the various agencies to discuss contingency plans further, it would be desirable for a standing liaison committee to be established in St. John's with representatives from the following organizations: COGLA, NLPD, Canadian Petroleum Association - Offshore Operators Division, two or more representatives of operating companies, Department of Health, Director of Emergency Measures, Director of Emergency Department of The General Hospital, MUN Centre for Offshore & Remote Medicine, Canadian Coast Guard and Search and Rescue.

Members of this committee, meeting at least two or three times yearly, could:

a) review collectively the emergency response capability of each organization,

b) make recommendations to their principals as appropriate,

c) discuss matters brought by member organizations, and

d) exchange information with similar groups that might be established in Nova Scotia and in northern Canada.

This committee could facilitate the holding of disaster exercises and assess the outcomes in order to make new recommendations.

It is understood that in Nova Scotia certain improvements are also needed to produce an adequate emergency response to an offshore disaster.

## 14.9 SUMMARY

1. COGLA and NLPD require the submission of contingency plans by all companies. Their regulations are reviewed briefly.

2. Contingency plans recognize a level of emergency which can be dealt with by the company alone and a level at which outside help is needed.

3. The roles of a number of federal and provincial departments and agencies are described.

4. The contingency plans submitted by three companies are reviewed. Of these, only one is considered to be satisfactory.

5. The roles and responsibilities of the medic and the physician must be set out definitively and the decision on whether to evacuate or not should be clearly their major responsibility.

6. Active involvement of health and safety professionals from industry and other agencies should be sought in the development of medical emergency contingency plans.

7. A standing liaison committee should be established to coordinate the activities and resources from all agencies and to review and update coordinated planning.

## 14.10 CONCLUSIONS

1. The operator's medical director should be responsible for medical emergency services for all rig workers. He may delegate the responsibility but it should not be delegated to more than one physician (with backup coverage) and the ultimate responsibility should always rest with the medical director of the operating company.

2. The operator will cope with the vast majority of problems within his own resources, calling on the usual health services onshore as needed.

3. Some advances have occurred in the coordination of resources of various agencies, but there is still uncertainty and potential for confusion and misinterpretation of responsibility.

4. A standing liaison committee on emergency contingency services composed of representatives of the major agencies, and required to meet regularly would facilitate the development of a plan acceptable to all with clarity of responsibility being identified.

## REFERENCES

1. Canada Oil and Gas Drilling Regulations, Canada Oil and Gas Lands Administration, November 1980, Section 171, pp. 61-62.

2. Cox, R.A.F., "An Emergency Plan for and Offshore Disaster", The Practitioner, Vol. 205, November 1970, p. 663.

3. Minutes of a Meeting to Consider Emergency and Urgent Offshore Medical Response Capacity and Organization, Centre for Offshore and Remote Medicine, Memorial University of Newfoundland, February 23, 1983, p. 3.

4. Minutes of Second Meeting to Consider Emergency and Urgent Offshore Medical Response Capacity, Centre for Offshore and Remote Medicine, Memorial University of Newfoundland, March 31, 1983, pp. 2-3.

5. Canada Oil and Gas Lands Administration, Emergency Response Plan (Draft) February 1983, Section 3.3, p. 22.

6. Canada Oil and Gas Lands Administration, Emergency Response Plan, (Draft) February 1983, Section 4.5, p. 26.

7. Ibid, Section 4.4, p. 26.

8. Ibid, Section 4.3, p. 26.

9. Correspondence from Search and Rescue, St. John's, April 21, 1983.

10. Province of Newfoundland and Labrador Accident Occurrences Contingency Plan Concerning Offshore Petroleum Related Activities, (Draft) January 1983, Section 2.2, p. 2.

11. Ibid, Section 2.7 (a), p. 4.

12. Ibid, Section 2.7 (b), p. 4.

13. "Major Reorganization in Health Department: Out of it Comes New Division", The Daily News, July 18 1983, p. 3.

14. Correspondence with the General Hospital, October 11, 1983.

# BIBLIOGRAPHY


1. Canada Oil and Gas Lands Administration, "Contingency Plan Guidelines for Drilling Operators in the Canadian Offshore", Ottawa, 1983, pp. 1-20.

2. Schropp, R.D.; "The Reaction at the Operator's Head Office During Emergency Situations Offshore", pp. 1-9.

3. Bjornestad, Sven; "A Norwegian Operator's Contingency Model", pp. 1-10.

4. Jones, Dr. C; "A U.K. Operator's Contingency Model", pp. 1-11.

5. Hielm, J.; "An Appreciation of the Requirements for Dealing with Emergencies Offshore", Proceedings from Occupational Health and Safety of Workers in the Petroleum Extractive Industry, Luxembourg, April 19-20, 1983, pp. 799-212.

6. Proctor, D.M.; "Onshore Support in the Case of Major Incidents", Proceedings from Occupational Health and Safety of Workers in the Petroleum Extractive Industry, Luxembourg, April 19-20, 1983, pp. 297-305.

Chapter 15

## CONCLUSIONS

In the course of this study, it became apparent that in many areas, Federal and Provincial agencies had started to define their involvement and responsibilities with health and safety matters in offshore oil operations. The report recognizes this and indicates that there is still some need for development, particularly where cooperation and integrated action is required.

As far as the industry is concerned, issues of health and safety may not have received the highest priority. This may be due to the limited medical input into administrative decision-making. Some re-evaluation of the role of the medical director may help to achieve this input and result in a more balanced emphasis on health and safety. It is appreciated that the further industry progresses in dealing with health and safety, the less will be the need for detailed government control by legislation.

In a sense, the emphasis on health services in this report reflects current thinking in which the need for prevention is acknowledged, but the means of caring for an accident victim or for a sick person are nevertheless stressed.

In the short run, prevention must be stressed by careful pre-employment assessment, by improving rescue facilities and by better survival training. However, the basic problem of human factors will remain. If certain industrial offshore operations such as diving and the manual handling of drill equipment are to continue, there will be accidents, and the outcome of prevention may simply be the reduction in their severity.

In the long run, it may be better to reduce the human component and to direct efforts to developing machines with artificial intelligence which can undertake complex unmanned manoeuvres. The next generation of robots may well be able to perform the necessary techniques, such that undersea operations could be accomplished with a reduced need for divers or for manned underwater vessels, or for drilling operations to be conducted without hazard to the handlers. This emphasis on robotics may appear fanciful, but it is a rapidly developing field. Even at present, it can be argued that using special sensors to detect gases and chemicals and automatically prevent explosions and poisonings is better than having to rescue and treat victims.

Safety engineering should address more basic problems than the provision of better and safer life saving equipment. Designers and safety engineers with full involvement of specialists in ergonomics should involve themselves in the development of technical sytems to meet the demands for efficient production and

make the facilities safer places for humans to work, by reducing the need for human input. Technological advances which have resulted in the computer microchip, space flight and inertial navigation should be able to satisfy the need for production of renewable and non-renewable resources while, at the same time, reducing to a minimum human suffering and death in those industries.